

FINAL REPORT FOR THE PERIOD
1 APRIL 1967 to 31 MARCH 1968

New England
Research Application Center
University of Connecticut
Storrs, Connecticut 06268

FACILITY FORM 602

(ACCESSION NUMBER)

91

(PAGES)

CR-93763

(NASA CR OR TMX OR AD NUMBER)

(THRU)

1

(CODE)

34

(CATEGORY)

AN ACCOUNT OF THE ACTIVITIES AND RESULTS
OF THE FIRST YEAR OF OPERATION OF THE
NEW ENGLAND RESEARCH APPLICATION CENTER.

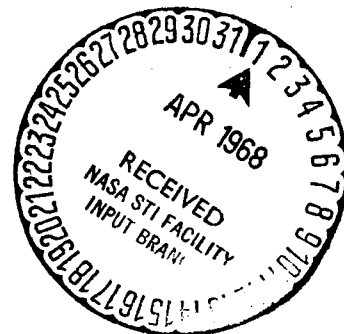
FINAL REPORT FOR THE PERIOD
1 APRIL 1967 TO 31 MARCH 1968.

Prepared for the
National Aeronautics and Space Administration
Washington D.C. 20546

By the
New England Research Application Center
School of Business Administration
University of Connecticut
Storrs, Connecticut 06268

Under Contract NSR 07-002-029

31 March 1968



SUMMARY

The results of the first 12 months work of the New England Research Application Center as a newly established information dissemination resource, are presented. Reference is made to the context, aims and imperatives of the work and a summarized chronology of the major events given. Quantitative results are presented with analyses. The generality and specifics of the problems associated with Technology Transfer and Utilization are ventilated. Factual evidence of 'client' satisfaction is also presented. Some general observations and comments on future trends conclude the report.

TABLE OF CONTENTS

SUMMARY	i
I. INTRODUCTION	1
II. A SUMMARIZED CHRONOLOGY OF THE OPERATIONAL DEVELOPMENT OF THE NEW ENGLAND RESEARCH APPLICATION CENTER FROM 1 APRIL 1967 THROUGH 31 MARCH 1968	4
III. SOME QUANTITATIVE RESULTS	13
IV. SOME OBSERVATIONS ON AND EXAMPLES OF TECHNOLOGY TRANSFER	23
V. GENERAL OBSERVATIONS, CONCLUSIONS AND FUTURE TRENDS	33
APPENDIX A: IMPROVING EFFECTIVE UTILIZATION OF INFORMATION IN TECHNICALLY BASED ORGANIZATIONS.	39
APPENDIX B: REPORT ON EXPERIMENTAL INFORMATION SEARCH PROGRAM FOR UNIVERSITY OF CONNECTICUT FACULTY MEMBERS OVER THE PERIOD 11/1/67 TO 3/31/68.	62
APPENDIX C: CHECK LIST: GUIDE TO DOCUMENTATION OF CLIENT FIRMS, AND CLIENT/NERAC RELATIONS.	83

I. INTRODUCTION

This document reports the work of the New England Research Application Center from 1 April 1967 through 31 March 1968. It can be read in conjunction with three progress reports issued to cover the periods 1 April 1967 to 30 June 1967, 1 July 1967 to 30 September 1967 and 1 October 1967 to 31 December 1967. Taken together all four reports are considered to be responsive to the University's contractual obligations to submit Quarterly Progress Reports ". . . within fifteen (15) calendar days after the third, sixth and ninth months of performance. . . ." and a Final Report ". . . within twelve (12) months from the initiation of performance. . . ."

An examination of the terms of the contract, the proposal on which the contract was based and the conclusions and recommendations of an earlier Feasibility Study is useful in putting the work performed into perspective and context. The Feasibility Study stated: "Careful analysis of New England's economy together with a detailed study of a cross-section of New England industry is shown to demonstrate a vital need for the NASA Technology Utilization Program. Intensive interviews with top management and an extensive survey of the technological and corporate characteristics that potentially affect technology transfer and the utilization of externally derived knowledge have identified five categories of firms requiring unique services from a regional dissemination center."

In conclusion, it recommended that ". . . NASA establish a regional dissemination center at the University of Connecticut to help fill the unmet needs of New England industry for technology. This course of action would further the NASA objective of increasing technology utilization in the non-aerospace sector of the economy. The unique organizational structure proposed, the service packages designed to serve all parts of industry and the nature of the many, small, technically oriented firms in the region are the ingredients of what should prove to be a highly successful experiment for the Technology Utilization Program."

These conclusions and recommendations were subsequently incorporated in a "Proposal for the Establishment of a Regional Dissemination Center for New England." This proposal stated, inter alia, that (a) ". . . based on . . . the economic analysis of income and operations costs involved in servicing these needs, expectations are that the center would be self-supporting after three years of operation." (b) "The various segments of industry, their particular needs for technology and the appropriate means for filling these needs. . . [as] . . . described in the Feasibility Study . . . will be followed on an experimental basis by the proposed center. The Feasibility Study defined many of the potential parameters, or characteristics, that influence a firm's acquisition and utilization of externally derived knowledge. In addition, the Study developed approaches that should be considered experimental in nature until proven or modified by experience. Therefore, the posture of the center will be one of continuously testing and evaluating these approaches to technology transfer in order to learn more about the process."

This proposal was accepted by the National Aeronautics and Space Administration and a contract (NSR 07-002-029) was executed on 27 June 1967. The contract allowed a ". . . reimbursement for costs incurred in an amount not to exceed \$50,000 on or after April 1, 1967, which, if incurred after this contract has been entered into, would have been reimbursable under the provisions of this contract." This condition effectively dated the establishment of the New England Research Application Center as of 1 April 1967.

The recommendations of the Feasibility Study and the essential content of the subsequent proposal were incorporated into the contract in the form of a statement of work, which stated, "The contractor shall use its best efforts to solicit fee-paying subscribers for a service involving the selective provision of scientific and other information included in the National Aeronautics and Space Administration information resource made available by the Government to the contractor for this purpose; provided, however, that nothing herein shall be construed to limit the contractor from adding to that resource and expanding the contractor's information base through otherwise available sources likely to be useful to clients; and, further provided, that the contractor shall, to the extent that projections based on good business practice and experience permit, establish the price of individual services offered according to the cost of providing such services.

Specifically, the contractor shall, depending upon the determined needs of its market, provide the following services to client subscribers.

- (1) Retrospective searching of the information resource including:
 - (a) Pre-search analysis of posed questions by a staff

member or consultant;

- (b) Computerized or manual information retrieval from the information resource;
- (c) Post-search analysis by a staff member or consultant;
- (d) Delivery to users of abstracts selected for relevance;
- (e) Provision of hard-copy when requested;
- (f) Interpretative or advisory service as required and feasible concerning the use of information provided.

(2) Selected dissemination service including:

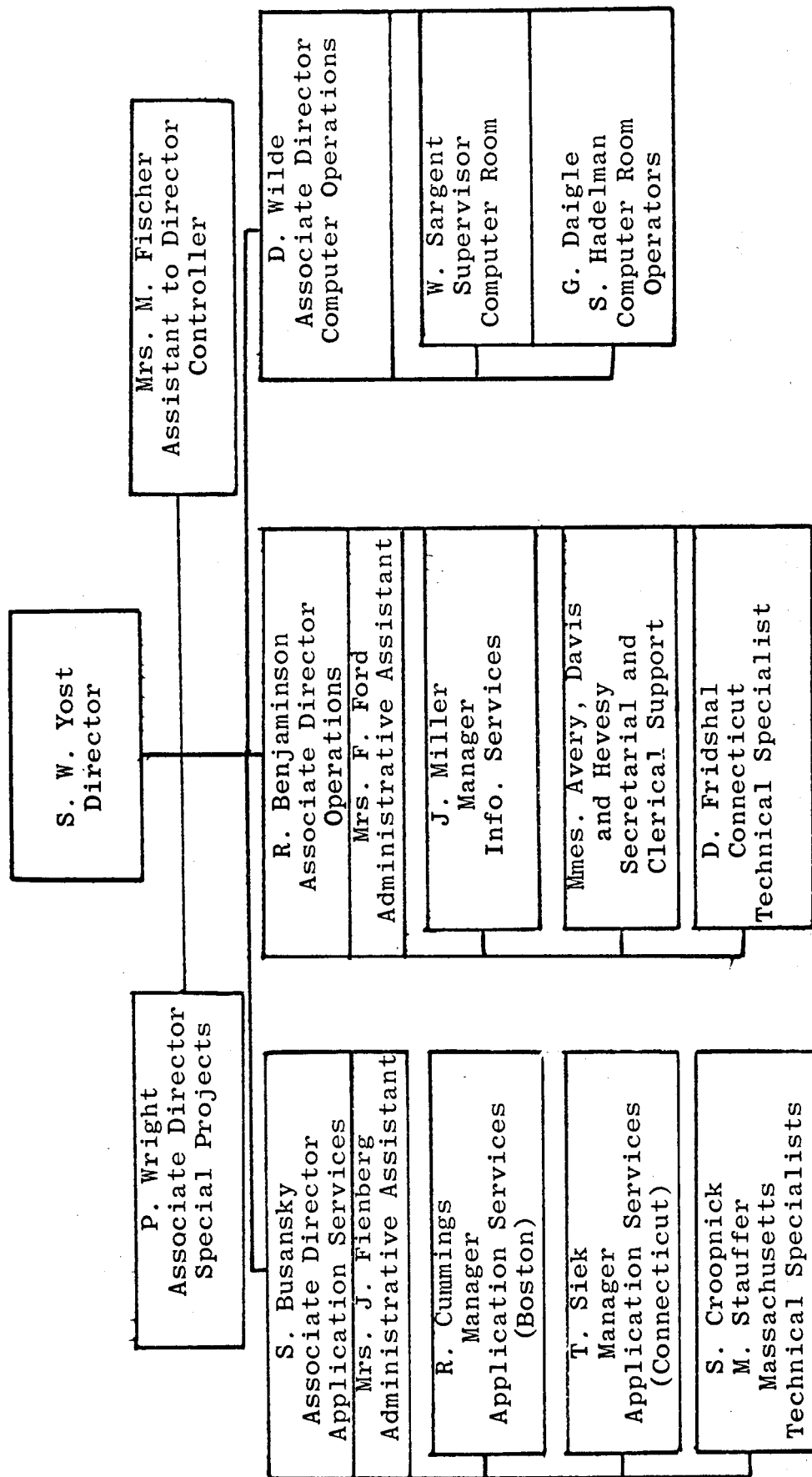
- (a) The development, updating, and use of custom interest profiles derived by staff members or consultants in coordination with client staff members and designed to meet a particularized scientific or technical or managerial interest of a client;
- (b) The development, updating, and use of standard interest profiles covering subjects of general interest to clients."

II. A SUMMARIZED CHRONOLOGY OF
THE OPERATIONAL DEVELOPMENT OF
THE NEW ENGLAND RESEARCH
APPLICATION CENTER FROM
1 APRIL 1967 THROUGH 31 MARCH 1968.

The first three months were primarily devoted to becoming operational. The recruitment of staff, the acquisition of data, documents and equipment and the movement into larger quarters took place during this time. The estimated date for achieving full operational status was, at that time, 10 July 1967. Marketing efforts were delayed until essentially immediate service was possible. Case documentation activities were initiated in order to establish an initial point of reference. Work for a management workshop in technology transfer and utilization was begun as was work on proposals to the State Technical Services groups in Connecticut and Massachusetts. Retrieval programs for the IBM 1401 Computer had been completed during the Feasibility Study and had resulted in a reduction of the accepted search time of an order of magnitude. In effect, the computer was ready for business by 1 July 1967.

The second quarter (1 July 1967 to 30 September 1967) saw a continuation of the recruitment of staff which resulted in the acquisition of several excellent professionals. A minor reorganization of responsibilities brought all marketing and application services under one head. (See Figure 1)

FIGURE 1. ORGANIZATIONAL CHART, SEPTEMBER 26, 1967
NEW ENGLAND RESEARCH APPLICATION CENTER



S. Doctors: Technology Transfer Consultant to Dean,
School of Business Administration

Full operational status was secured in July and by the end of the quarter some 171 retrospective searches had been run including 58 for other RDC's. Six current awareness searches had been run. Total clients acquired stood at twenty and accelerated marketing activity was taking place at the quarter's end. It was however noted that a high proportion of the companies that had signed the letters of intent had failed to become clients. Summer doldrums in New England also accounted for a considerable amount of difficulty in getting off the ground in July and August. The success ratio appeared to be improving in September and it was hoped that this momentum would bring significant results in client acquisition in the next quarter. Hindsight shows that this was the first evidence to appear that the marketing effort for success needed to be greater than was first envisaged.

Also under various stages of consideration were twelve special projects to provide a variety of service to the University, State Technical Service programs and NASA. A branch office was established to coordinate services in Massachusetts. A document on the basis of which the development of a three day seminar/workshop in technology transfer might be effected was also produced (See Appendix A, Page 39). The NERAC Advisory Board was finally completed and at that time comprised:

Dr. Leonid V. Azaroff
University of Connecticut

Mr. Sumner Meyers
Institute of Public Administration

Dr. Arthur B. Bronwell
University of Connecticut

Mr. Erwin Pietz, President
Associated Industries of Mass.

Dr. John S. Burlew
Connecticut Research Commission

Dr. Edward B. Roberts
Sloan School of Management

Dr. Robert Fetter
Yale University

Dr. Richard S. Rosenbloom
Harvard University

Mr. Robert S. Goodyear
Fenwall Electronics Corporation

Dr. Albert W. Snoke
Yale-New Haven Hospital

Dr. Robert O. Harvey (Chairman)
University of Connecticut

Mr. Frederick Waterhouse
The Manufacturers Association of
Connecticut

Dr. Harold G. Hewitt
University of Connecticut

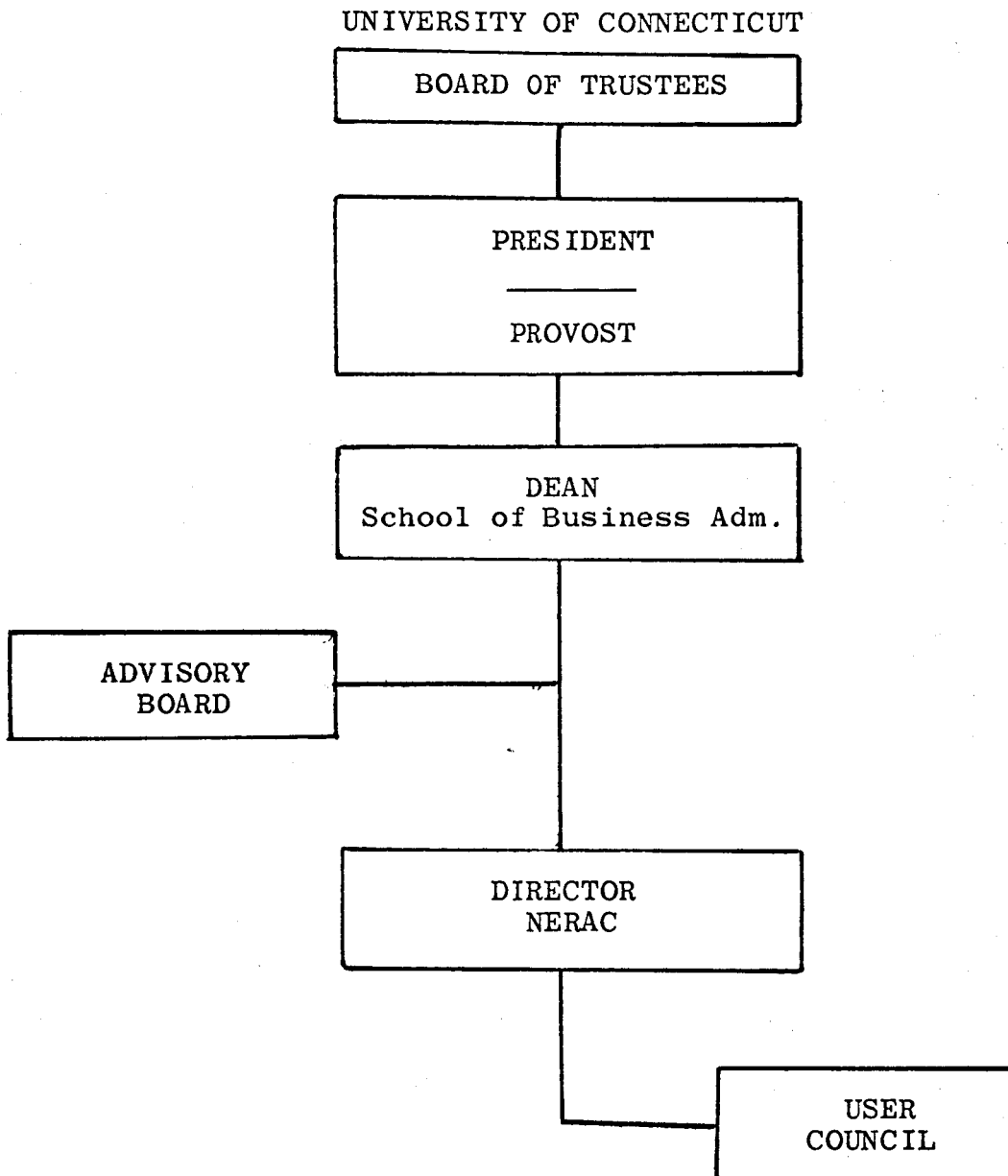
Mr. S. William Yost (Secretary)
Director, New England Research
Application Center

Mr. Leroy Jones
Department of Community Affairs
State Office Building, Conn.

Mr. John P. McDonald
University of Connecticut

The relationship of NERAC to the University and to its advisors is pictorially demonstrated in Figure 2 (a).

FIGURE 2 (a) NERAC RELATIONSHIPS (SEPT. 1967)



By the end of the third quarter (1 October 1967 through 31 December 1967) several things had transpired.

In the first place it was becoming increasingly clear that the effort of the Application Service Division required intensification, and there was an increasing awareness of the interaction and the inter-dependence of the different divisions within NERAC's organizational structure that tended to blur these distinctions.

In organizational matters, the leaving of the Associate Director for Application Services made it necessary to redeploy the effort of the Associate Director for Special Projects who assumed the position of Associate Director-Application Services. Towards the end of the period also, the Associate Director for Operations began to devote half-time to Application Services. The Manager of Application Services (Connecticut) transferred the location of his work to the Boston Regional Office.

The rate of industrial contact by a variety of methods was increased. At the end of the quarter the situation was:

437 approaches made

294 responses achieved (67%)

Of these responses,

119 were active (40%)

61 were negative (21%)

52 were passive. (18%)

12 were unresolved (4%)

50* resulted in the retention of NERAC's services (17%)

The geographical location of "clients" was

Massachusetts 26

Connecticut 18

New York. 2

Vermont 1

New Jersey. 1

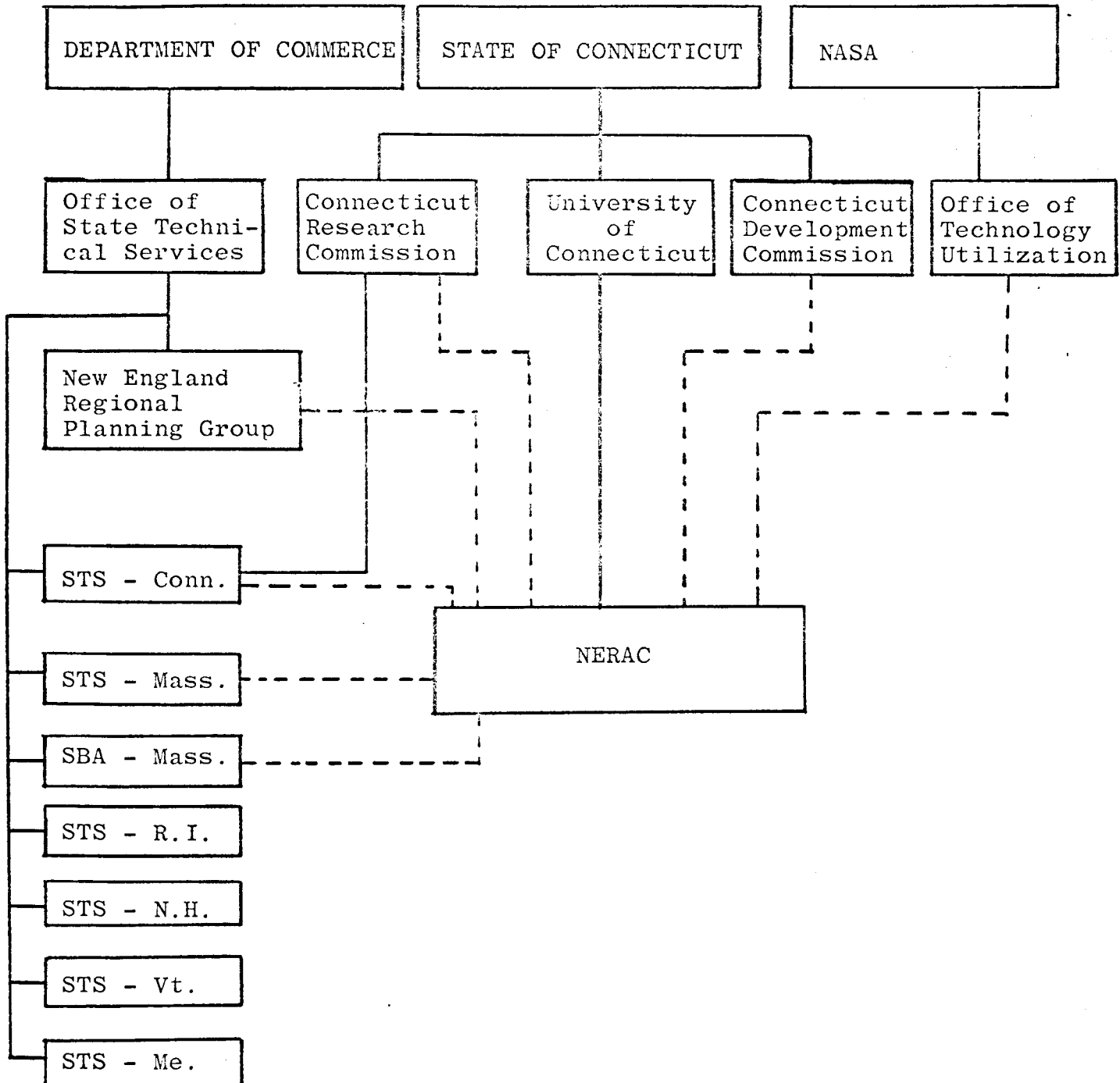
Rhode Island. 1

Colorado. 1

*Two of these relate to retainers for special services.

In addition the increasing inter-relationship with both Federal and State bodies is depicted in Figure 2 (b).

FIGURE 2(b) NERAC RELATIONSHIPS (SEPT. 1967)



Of particular interest was the retention of NERAC's services by the University of Connecticut Research Foundation in an experimental exploration of the viability of subsidizing an effort to satisfy the hidden information requirements of faculty members. The offered service was over-subscribed within one week.

Liaison with Federal and State agencies was intensified. Several presentations were made to local city groups of industrialists and business leaders. However, no particular pattern for effective "client" recruitment emerged. Each situation had differing characteristics. It was clear however that a continuing and intensified exposure of NERAC's services to industry and others in the New England region had to be maintained.

On behalf of all clients, the following services had been performed by the end of the third quarter:

1.	Retrospective Searches Completed	
	for clients	55
	for Regional Dissemination Centers	85
	for University of Connecticut	
	Research Foundation	22
2.	Current Awareness Searches Completed	
	for clients	35
3.	Number of Documents Ordered	292

During the period, NERAC computer operations continued as a highly reliable, almost independent retrieval system with minimal computer operator interaction. Even though computer searches were run almost daily during the period, all searches ran to completion and all computer output was valid. In addition, all computer searches were performed within a guaranteed 24-hours turn-around time. Minor changes were made in the computer search system to improve its operating convenience and execution time. Provision was made for accepting TECH BRIEF accessions on the linear file. Several students completed non-paid NERAC staff projects for academic credit.

Of twelve current special projects one came to fruition during the quarter. The Denver Research Institute retained NERAC for the provision of special advice and guidance in the establishment of its project for the Analysis of Technology Transfer. In addition, minimal study efforts were being conducted in the following areas that affect NERAC policies, operations, and marketing strategies:

Federal Agency patent, license and proprietary data policies.

Technology and the new Federal Program aimed at crime

prevention and detection.

Technologically deprived industries in New England.

With increased experience in serving clients satisfactorily the imperatives for broadening the retrieval data base sharpened. As a result preliminary contact was established with twenty centers of specialized information with a view to deploying their expertise and resources on behalf of NERAC's clientele. Intensive liaison with the University of Connecticut Library was also increased with the same end in view.

The first meeting of the NERAC Advisory Committee was held in October 1967. The discussions were essentially explanatory and expository in nature.

The fourth quarter (1 January 1968 through 31 March 1968) showed a continued intensification of marketing activities, the award of funds for two special projects for the Connecticut State Government, the completion of work on Faculty Searches for the University of Connecticut Research Foundation, (See Appendix B, p.62 for a report), a welcome diversification of activity in conjunction with the School of Agriculture in an unusual project for an industrial client and an increasing awareness by the University of Connecticut Library of the merit to it of the complementary and supplementary services offered by NERAC.

The Associate Director for Marketing and Special Projects was appointed Deputy Director. The Associate Director for Operations accepted a special assignment to work full time in Marketing and Applications Services. The Manager of Information Services accepted operational responsibility for his group and increased his contribution to the marketing efforts.

A Program Review of NERAC's activities and progress was held jointly between officers of the NASA's Technology Utilization Division and NERAC staff and was concluded satisfactorily. A second meeting of the NERAC Advisory Committee was held, during which the Committee devoted much effort to offering guidelines about NERAC's future activities. In summary, these were:

1. Client satisfaction should be the primary aim even if this had implications for broadening the data base.
2. The fact that NERAC has been more successful, at least financially, thus far in contracting for searches and related services to be provided to governmental and other non-profit groups was examined in terms of its implications for future business. It was pointed out that NERAC is essentially a consultant engaged in selling its service. As such, the curve of increasing sales is bound to rise very slowly while the Center

works to demonstrate a few "successes" and to gain client acceptance. NERAC was urged to regard funds from grants and related sources as necessary work and income while the Center is becoming established in its primary business of working with client firms to assist them to locate and utilize technological data appropriate to their needs and growth interests. It was considered that, given four representatives (Applications Specialists), one should be allocated to the public sector while the other three should invest their time and effort in opening up the industrial market. The return on this investment might not be fast; it would, however, be solid and lasting when it arrived. All members of the Advisory Board concurred with this conclusion.

3. The routes by which NERAC can become self-supporting by the end of another three years were identified as:
 - a. raising fees for searches presently being carried out,
 - b. increasing repeat business with more client requirements and shorter intervals between requests, or
 - c. working with clients on an annual contract basis.

It was concluded that NERAC's greatest asset at this time is the clients known to be satisfied with their relations with NERAC and with the benefits they have derived from this relationship since they will be more valuable for referrals than anything else at this stage of development.

4. The Board endorsed an approach whereby NERAC will continue to seek new clients by introducing Retrospective Searches for limited periods of time and then concentrate on present clients and selected prospects to "mine" the existing client relationships for preferred leads and for annual contracts with clients.

Quantitative results of the year's activities are given in Section III. Suffice it to say here that by 31 March 1968, 75 'clients' both from the private and public sector had been acquired and serviced.

One final point deserves mention and concerns operations planning and control by simulation. During the year the Center has participated in the University's MBA program to the extent of having its operations studied by a team of graduate students. This operations research project resulted in a detailed flow chart of all operations. A manual simulation performed by the students established the feasibility and usefulness of the technique in evaluating policy and operations alternatives. Two measures of effectiveness were identified as operation costs and search turnaround time.

Following this study the Center's operations were programmed for the IBM 360/65 computer using the General Purpose Simulation System (GPSS) language. The model is presently undergoing validation and sensitivity testing. During the budget period 1968-69 the model will be used to test the impact of operation changes on costs and search turnaround. In addition, the model will be used to set planning goals based on the predicted level of operations. Exceptions from these plans in terms of costs and/or turnaround time will signal for management attention. The successful application of simulation techniques to the planning and control of operations will mark a significant breakthrough in Regional Dissemination Center management.

III. SOME QUANTITATIVE RESULTS

As was noted in the previous section (page 12) the total number of companies and organizations, both in the private and public sectors, buying service from NERAC during the year was 75. Of these, 68 were bona-fide industrial companies and the remaining 7 came from what can be generally termed the 'public sector'. It is somewhat misleading to use the number of 'clients' as a measure either of the effectiveness of the NERAC service or of the amount of work performed but it is popularly employed in this manner and thus requires attention and analysis. Unfortunately the due date for this report coincides with the terminal date of the period under review and in these circumstances it is impossible to present an up-to-date detailed analysis. In these circumstances, what is reported is an analysis of the position as it existed on 31 January 1968. At this time the total number of 'clients' was 57, 51 from the private sector and 6 from the public sector. It is contended that the results of this analysis bear a close relationship to any analysis of the position at 31 March 1968.

1. Modes of 'Client' Acquisition

22 or 39%		came from the Feasibility Study
of these	15 or 26%	came from the Questionnaire follow-up
	7 or 12%	came from the Letters of Intent
12 or 21%		came from New individual presentations
9 or 16%		came from Shows and group presentations
8 or 14%		came By referral
6 or 10%		came from Previously known contacts
0 or 0%		came from Tech Brief "bait"
<hr/>		
57 or 100%	Total	

2. Analysis of Over-all Results for Each Mode of 'Client' Acquisition

a) Breakdown of Approaches for Each Mode

332 or 57% came from the Feasibility Study and new individual presentations
136 or 23% came from Previously known contacts
71 or 12% came from Shows and group presentations
25 or 4% came from Tech Brief "bait"
17 or 3% were Referrals

581 or 100% Total

b) Breakdown of Results from Feasibility Study and New Individual Presentations

'Clients'	34 or 10%
Active	102 or 31%
Passive	33 or 10%
Negative	37 or 11%
Unresolved	115 or 35%
Presumed stale non-responses	<u>11 or 3%</u>

332 or 100%

c) Breakdown of Results from Previously Known Contacts

'Clients'	6 or 4%
Active	10 or 7%
Passive	12 or 9%
Negative	9 or 7%
Unresolved	6 or 4%
Presumed stale non-responses	<u>93 or 69%</u>

136 or 100%

d) Breakdown of Results from Shows and Group Presentations

'Clients'	9 or 13%
Active	8 or 11%
Passive	6 or 8%
Negative	12 or 17%
Unresolved	<u>36 or 50%</u>

71 or 99%

e) Breakdown of Results from Tech Brief "Bait"

'Clients'	0 or 0%
Active	6 or 24%
Passive	1 or 4%
Negative	0 or 0%
Unresolved	2 or 8%
Presumed stale non-responses	<u>16 or 64%</u>
	25 or 100%

f) Breakdown of Results from Referrals

'Clients'	8 or 47%
Active	4 or 23%
Passive	1 or 6%
Negative	1 or 6%
Unresolved	<u>3 or 18%</u>
	17 or 100%

As would be expected the greatest proportion of 'clients' acquired (39%) came from contacts made during the Feasibility Study -- from those companies responding to a questionnaire and those signing letters of intent to use the NERAC services. The gestation period between the initial contact during the Feasibility Study and the point at which NERAC's services were retained was, in the nature of things, at least 6 months and subsequent results show that the elapse of this time is a strong characteristic of most industrial decision making in this respect. Psychologically and tactically too, approaches to previous NERAC contacts is clearly an optimum mode for marketing. Perhaps because of the lessons learnt during the Feasibility Study about the need and efficacy (in terms of persuasion) of individual presentations (one way or another), this mode of marketing persisted with presentations to new potential 'clients' and was successful in that, together with 'clients' acquired from the Feasibility Study reservoir, it accounted for 60% of the total 'client' acquisition. However, the overall efficiency of this mode of acquisition was only just over 10%. This appears low but in the absence of any figures for comparison purposes, a definitive conclusion here is not prudent. In addition, many of these presentations may have started the clock going in terms of an ultimate affirmative decision still to be made and others might be the seed for referral of still other potential 'clients'.

In terms of efficiency, namely the percentage ratio of 'clients' acquired to the number of approaches made to initiate dialogues (and ignoring the importance in terms of total income

of the actual numbers of 'clients' acquired) the following comparison of other modes of 'client' acquisition is enlightening.

From Referrals47%
From Shows and Group Presentations13%
From Previously Known Contacts	4%

These figures clearly point the way to modifications of marketing strategies.

Figure 3 shows the NERAC industrial 'client' growth, expressed in terms of the numbers of 'clients' acquired and the relative numbers of retrospective and current awareness searches performed.

Figure 3.

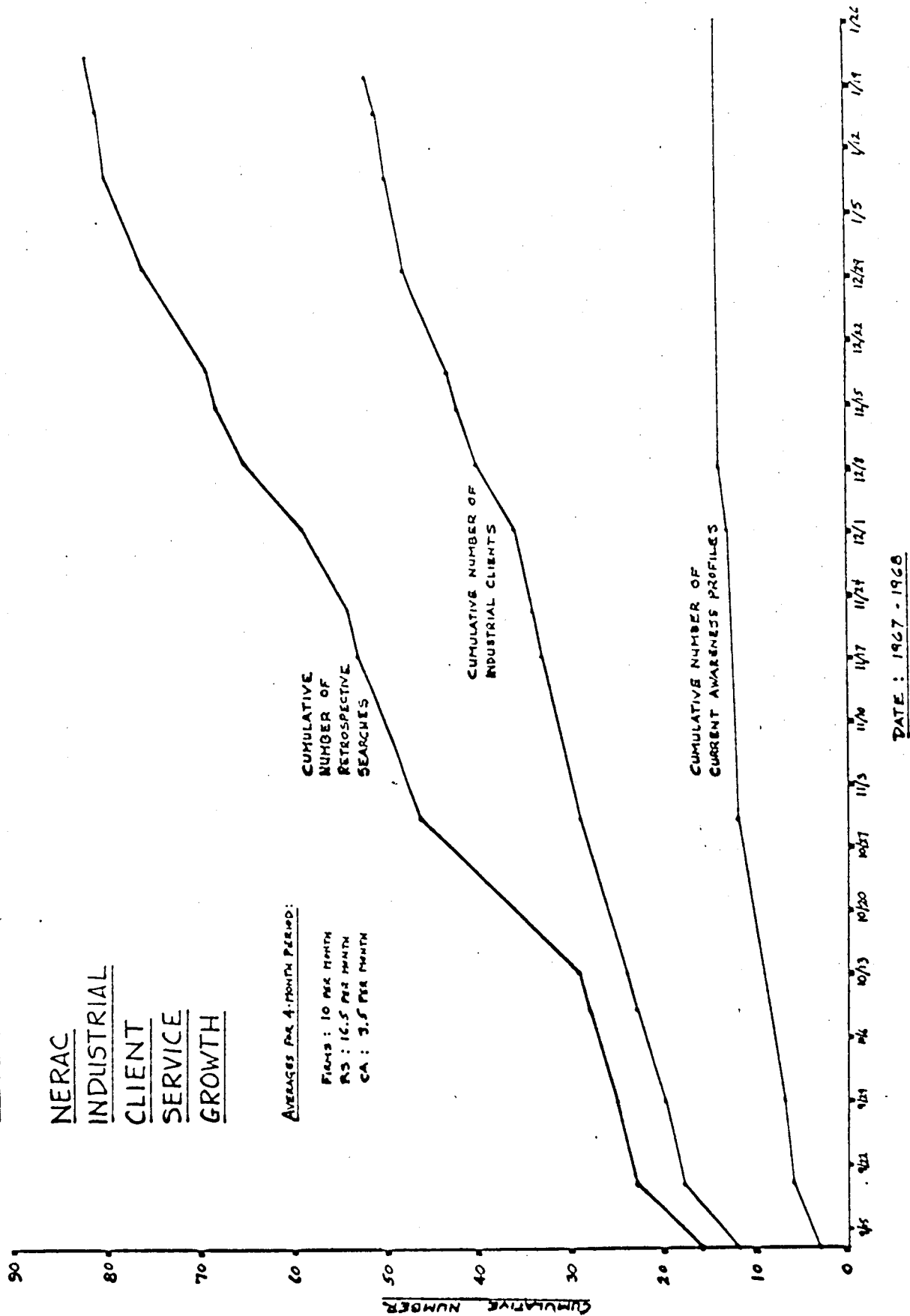
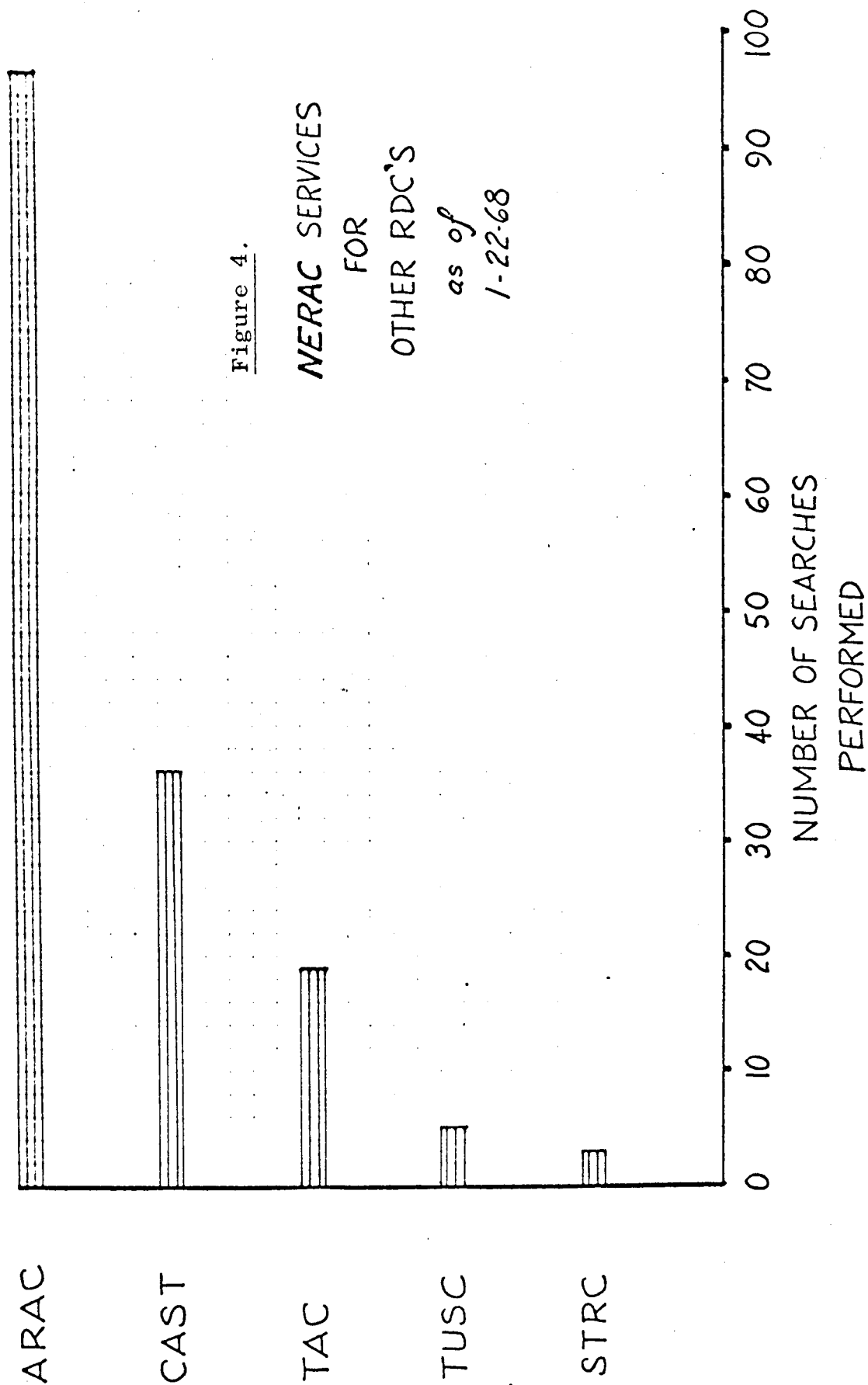


Figure 4, of related interest, shows the number of searches performed on behalf of sister Regional Dissemination Centers.



An analysis of some of the characteristics of 'clients' acquired during the period under review is of revealing interest.

1. Contact Point Position within 'Client' Organization

<u>Position</u>	<u>Number</u>	<u>Per Cent</u>
Top Management <u>per se</u>	21	42
Technical Staff Professional (Top Management)	14	28
Line Operation Management	7	14
Technical Staff Professional <u>per se</u>	4	8
Information Specialists	4	8
	50	100

N.B. Seven 'clients' were unclassifiable.

2. 'Client' Organization Size by Number of Employees.

<u>No. of Employees</u>	<u>No. of 'Clients' in Group</u>	<u>Per Cent</u>
1-10	5	10
11-50	8	16
51-100	4	8
101-500	13	25
501-1000	6	12
over 1000	15	29
	51	100

N.B. Six 'Clients' were unclassifiable.

3. 'Clients' Characterized by Standard Industrial Classification (SIC)

<u>SIC</u>	<u>Description</u>	<u>Number</u>	<u>Per Cent</u>
36	Electrical Machinery Equipment and Supplies	13	23
35	Machinery except Electrical	11	20
34	Fabricated Metal Products except Ordnance Machinery and Transportation Equipment	8	14
28	Chemicals and Allied Products	7	12
--	Unclassifiable	5	9
38	Professional Scientific and Controlling Instruments: Photographic and Optical Goods: Watches and Clocks	4	7
73	Miscellaneous Business Services	4	7
19	Ordnance and Accessories	1	<2
26	Paper and Allied Products	1	<2
30	Rubber and Misc. Plastics Products	1	<2
32	Stone, Clay and Glass Products	1	<2
37	Transportation Equipment	1	<2
		57	100

In the context of the Standard Industrial Classification of companies it is useful to note that approaches were made to companies in 24 two digit SIC codes, 'clients' were obtained in 12 of them and the client/response/no response ratios for each SIC code were in general very similar.

4. Contacts and 'Clients' characterized by Geographical Location.

<u>State</u>	<u>Contacts</u>		<u>Clients</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
Massachusetts	315	54	29	51
Connecticut	168	29	21	37
New York	37	6	3	5
New Jersey	24	4	1	2
Rhode Island	13	2	1	2
Colorado	24	4	2	3
Georgia				
Illinois				
Kentucky				
Maine				
Maryland				
Michigan				
Mississippi				
New Hampshire				
Ohio				
Pennsylvania				
Vermont				
California				
Total	581	100	57	100

5. Types of Services preferred by 'Clients'

- 31 clients took a single Retrospective Search
- 16 clients took multiple Retrospective Search and/or converted a single Retrospective Search into a Current Awareness
- 6 clients took a Retrospective Search/Current Awareness
- 3 clients took special conventional services
- 1 client took special unconventional services

It is not unreasonable to view this breakdown of services preferred as an indication of 'client's' intentions regarding annual membership. If the 31 clients taking single retrospective searches and the one client taking special unconventional services are excluded from further consideration, it is fair to state that the remaining 25 (44%) show a more than average prognosis for some form of annual participation.

All of the foregoing analysis is based on events up to the end of January 1968. In summary form it is possible to give

quantitative results up to the end of the period under review without the benefit of such a detailed analysis. These are:

of 937 attempts to initiate dialogues:

574 (61%) remain unresolved

[338 or 36% await definition
144 or 15% are active
92 or 10% are passive]

160 (17%) have not received a response

128 (14%) are negative

75 (8%) are 'clients'

From another point of view:

of 937 attempts to initiate dialogues:

677 (72%) have been initiated by NERAC

136 (15%) resulted from previous contacts

71 (8%) resulted from shows and conferences

28 (3%) resulted from referrals

25 (2%) resulted from use of Tech Brief "bait"

An analysis of 'client' acquisition modes shows that of the total of 75:

51 (68%) were initiated by NERAC

9 (12%) resulted from shows and conferences

8 (10%) resulted from referrals

7 (9%) resulted from previous contacts

0 (0%) resulted from the use of Tech Brief "bait"

The efficiency of 'client' acquisition as measured by the ratio of 'clients' acquired against the total number of attempts to initiate dialogues for each mode of client acquisition shows:

By referrals	25%
From shows and conferences	11%
Initiated by NERAC	7.5%
From previous contacts	6.5%
Using Tech Brief "bait".	0%

The implications of these figures should be considered in the context that the potentiality for change due to the gestation phenomenon referred to elsewhere is considerable.

From many points of view, a more precise and meaningful unit for the measurement and assessment of a Regional Dissemination Center's performance is the search itself. The following figures give brief details of performance up to the end of the contract period:

Total Number of Searches made	381
For Sister Regional Dissemination Centers	206 (54%)
[ARAC	128 (34%)
CAST	44 (11%)
TAC.	25 (6%)
TUSC	6 (2%)
NCSTRC	3 (1%)]
For Industry	138 (36%)
[Retrospective Searches	98 (26%)
Current Awareness*	40 (10%)]
For University of Connecticut Faculty.	33 (9%)
For Non Profit Institutions.	4 (1%)

* 15 annual searches have been ordered; 40 individual monthly searches have been completed to date.

IV. SOME OBSERVATIONS ON AND EXAMPLES OF TECHNOLOGY TRANSFER

The existence within NASA of a Technology Utilization Program is in itself sufficient reason for those concerned and involved to have an understanding of how the process of transfer and utilization works. As a Regional Dissemination Center which must become self-sufficient within three years, NERAC has a need to identify the technology transfer and utilization process and the steps that are involved in its operation. Directly related are a need to sell the services of this Center more effectively, to accept and fulfil its responsibilities as a member of the academic community and to facilitate the effective utilization of a proliferation of documented knowledge.

The process of technology transfer and utilization may in a sense be described as answers in search of any question to which they are applicable and relevant. Industrial scientists and engineers engaged in applied research or in the development or improvement of industrial products or processes represent one important segment of the present or potential need for data now available in NASA-supported or catalogued documentation. What forces or factors might influence these scientists and engineers to reach out for, or even to utilize information from external sources which may be relevant to their work? More readily apparent are the factors which tend to discourage such utilization.

A primary consideration is the nature of the men involved, and their own self-image as it relates to their work. Professionally trained scientists and engineers are usually regarded, and tend to regard themselves, as specialists and as experts. It is therefore difficult to visualize such an engineer or scientist saying to his employer or supervisor that he needs the services of a Regional Dissemination Center to enable him to "keep up" in a field in which he is an "expert". To do this, the engineer or scientist would have to be secure in his relations with his employer and an acknowledged leader among his peers. Conversely, for an employer or supervisor to suggest

to one of his technological personnel the use of a Regional Dissemination Center's services would be most difficult if there be an implication or inference of inadequacy. And this situation is true despite the admitted difficulty for engineers and scientists to keep up with the current developments in their respective fields. Dr. Gordon C. Brown, Dean of Engineering at the Massachusetts Institute of Technology in 1962 called attention to the fact that the "half-life" of an engineer's training was then ten years and growing shorter. When the Center for Continuing Education in Engineering was established at MIT in 1963 under a grant from Alfred P. Sloan and the Sloan Foundation this problem of inferring or implying a deficiency in--and hence the need for the bolstering of--one's professional competence was noted when the decision was made to place emphasis on courses of study as "refreshers" for men who were out of touch with a field for acceptable reasons and to stress study in the new horizons of engineering and science from which areas tomorrow's breakthroughs could be anticipated.

A second reason why the engineer or scientist may find it difficult to seek out data from external sources has to do with his inability to identify specifically what he is looking for. Often, the engineer has in mind a number of end-use performance criteria which can be met through the combination of many different factors. What he may be looking for would be any new development or improved capability in any one of these factors which may have been achieved in a context entirely foreign to his present interest. Frequently he may describe this as a "vague feeling"--something he cannot describe but would recognize if he saw it.

For example, an executive of the Worthington Corporation in 1963 described the practice of his firm to work almost continuously on three successive generations of each product manufactured and offered for sale. The first generation of any product is the generation now in production. Work on the design of the second generation product is concerned with improvements in the product with respect to ease of manufacture, performance capabilities, the incorporation of applicable technical advances and the improvement or addition of market features. When it comes to design for the third generation product, the approach is quite different. Questions are first raised about the function a product of this type will be called upon to perform ten years into the future. Next, the need for this function or others related to it which may exist ten years hence is examined to determine whether a growing market exists. Finally, the best way to design the product to perform the requisite function(s) using the best available or derivable technology is determined and the design and prototype are worked out. Here in this Worthington example is an illustration of one type of situation described above. The configuration which the Worthington product designer

will come up with for his "Third Generation" product will depend on all of the documentation selected for his study and utilization. Some of the reports of technological advances may be self-evidently relevant; others may not be. How, then, are they to be identified by the designer in the course of his search and study? And to what extent can any third party acting for the designer succeed in making an intelligent selection from the literature for him?

A third aspect of the various factors tending to discourage the transfer and utilization of technology is the informal inquiry/referral systems which exist in every laboratory or group situation in which engineers and scientists work. Considerable study has already identified the information flow or transfer process which develops among such groups of men. In each case a few men, who may or may not be the natural leaders, are quickly identified as information resource people and they are so identified because they are sought out by their peers to answer questions of: Do you know anything about. . . ? or, Where can I find out who would be working on. . . ? or, Has anyone ever heard of work being done on. . . ? These information resource people almost always seem to have the answer or some clue about where to look. Called by one author "cosmopolitans, because they have been around," these information resource people add to their fund of knowledge with every inquiry that is brought to them. The inquirers have to review what they already know in order to identify the point at which they need help. To continue in their roles as resources by their peers, the cosmopolitans must give good information or leads so that peer confidence to use the proffered information is maintained and strengthened. But how to enlist these cosmopolitans as users and supporters of Regional Dissemination Center's has not yet been discovered. Nor has the question of whether referral to Regional Dissemination Center's enhances or detracts from their positions of esteem among their peers been explored and resolved.

From these considerations it is apparent that the difficulties of introducing the use of searches, abstracts and selected documents which can be carried out and made available by a Regional Dissemination Center are numerous and formidable. The information, assistance and service is needed by scientists and development engineers because of:

1. the deterioration of their professional education vis-a-vis today's problems as their "years out" increase and must be compensated for;
2. their specialization due to their interests, their increasingly demanding assignments, and the constant expansion of their fields, which means there is an increasing area in which they must repeatedly be "brought up to date";

3. their recognition that in the proliferation of fields of study, of sub-disciplines, and of hyphenated areas of inquiry such as bio-engineering, relevant data is likely to be forthcoming which is far beyond their grasp;
4. the difficulty, at the formative stages of a research inquiry or development project, of defining the area of interest in terms of what is known to be relevant and yet providing for the necessary breadth of inquiry;
5. because being knowledgeable is the professional's stock-in-trade and his best avenue to peer recognition and selection for work assignments which offer the greatest likelihood of significant breakthroughs in the state of the art.

It would appear that a demand for the services of a Regional Dissemination Center can be created if a way can be found to present the services in a manner acceptable to the professional in the context of his organizational-, peer-, and self-image; which contribute to his professional development and capability; which provide assistance to him for problem-defining as well as problem-solving even when he is not yet in a position to identify the specific help he may need; and which extend his capability by enabling him to take into account forthcoming developments which may necessitate changes in the product, or in the way it will be used.

This discussion has been based in part on information previously available from other contexts, and on an analysis based on NERAC's experience with clients, prospects, and others in technology-based companies. It is presented in this manner because opportunities for the direct study of the technology transfer and utilization process are decidedly limited. Within the bounds set by budgetary limitations and the dictates of customer/client relations the following specific restraints have been identified:

1. the commitment that NERAC as a Regional Dissemination Center will have developed a clientele and income level such that it will be self-sufficient with respect to NASA support for operating expenses within three years dictates that its major, if not exclusive, effort be directed at securing and cultivating or strengthening relations with clients for its search and information services;
2. the work of studying the transfer/utilization process is not apparently regarded by NASA as a separate and parallel program objective;

3. effective NERAC/client relations appear to discourage any use of client organizations as "laboratories" for the purpose of studying the transfer and utilization process for these reasons:
 - a. efforts to make sales and secure the use of NERAC's services is difficult enough, and added activity might upset a delicate relationship;
 - b. participation for case documentation reasons might well change the nature of the relationship, as was evidenced by the operators in the Hawthorne Study; and
 - c. effective transfer agents and data users who would be most helpful would be likely to be those most "vital" to their employers, and men who should not be "bothered."

On the other hand, since proper documentation of all client contacts by NERAC representatives must be maintained for effective marketing performance and control purposes, this documentation can and does provide a means for study of the transfer/utilization process. This means of studying, of attempting to measure and to understand or interpret client utilization of information and assistance made available to him by NERAC does not easily lend itself to quantification. Yet there appear to be comparable situations in industry today where great reliance is placed on information which does not permit quantification.

A count of the number of automobiles rolling off an assembly line each day, week or month is significant for production and control reasons, of course, but how much more significant to the Division Vice President immediately concerned and to his corporation are the responses of the dealers and of the buying public to each new model as it goes on display. Favorable changes in the number of new car registrations tomorrow are, at least in part, a function of dealer enthusiasm and popular interest today.

Similarly, the response of those who are "test-driving" NERAC searches by relating abstracts and information to their needs is a potentially more meaningful measure of future business outlook than any count of abstracts distributed, significant though that may be for some purposes.

The paragraph descriptions which follow provide some evidence that technology transfers are in the process of fruition and that they were sought for a variety of purposes.

1. A company organized to prepare billets of metal for extruding and drawing was started in June, 1967.

Through information secured through NERAC, this firm was able to learn and to apply the techniques of "spade drilling" to form the desired large diameter holes in billets. Following a recent visit, the Applications Specialist reported that "they have just cut their first billet and were very successful . . . their prospective customers are very pleased . . . they have been requested to bid on the preparation of 72" billets as against the 36" size originally contemplated." Apparently this is a successful undertaking for a new business.

2. Sometimes there is a pay-off in the opposite direction. A metal specialty fabricator in central Connecticut requested searches in areas of its interest-- "excellent for catching up in areas and subjects new to them;" the corporate metallurgist really "didn't know how much literature was available and was pleased with what they got." A phone call to follow up on documents recently secured for the client brought forth the information that this firm was already preparing to set up a pilot operation to test a new approach when they learned through the information obtained that it had been tried by someone else and wouldn't work. The client was pleased to have been saved this time and expense (estimated at \$2000.00).
3. A western Massachusetts firm in the business of fabricating switches, seals, and other specialized components is preparing to build an infrared furnace as described in Tech Brief B66-10268.
4. Three different project groups of a central Massachusetts diversified manufacturer are now digesting material requested as a result of searches and abstracts supplied them. One indication of satisfaction resides in the request by a subsidiary of this firm in a nearby state for an additional search.
5. A small Connecticut firm which performs development projects for clients and is attempting to build its capability as a producer has utilized data from abstracts to support its own capability in a recent proposal to an agency of the Federal Government.
6. In one Connecticut firm in an old and highly competitive industry, a Vice President was asked to devote his full time to the development of both a capability for and prototypes of possible new products. When respondents to the survey conducted during the Feasibility Study were informed that NERAC was now operational, a telephone request for an initial search from this Vice

President was received even before the Applications Specialist called on him. This initial Retrospective Search was followed by a series of searches in various specialized fields suggested by abstracts secured earlier. Significantly, during this period the Vice President has progressed from his effort to catch up on the state of the art to one of design exploration.

7. A smaller Connecticut consulting firm is successfully using NERAC Retrospective Searches to help its engineers to acquire specialized technological backgrounds appropriate to the interests of their clients, to develop hypotheses, to eliminate approaches tried and found wanting elsewhere, and to locate as resource personnel individuals with expertise and interests in the area of client problems. The use of NERAC searches may well become a standard part of this firm's approach to work on each new client/problem area.
8. A central Massachusetts manufacturer of large structural capital equipment-type machinery recently ordered a computer for use by its design engineers and contracted with a firm specializing in that area to develop stress calculation programs. Concurrently, through NERAC this firm has located and secured five computer programs developed by various groups for this specific purpose so that for the cost of one NERAC search and the cost of programs through COSMIC, this NERAC client has, at a fraction of the cost, more and better programs than it could have obtained through its consultant.
9. Another central Massachusetts firm which specializes in the manufacture of tools and custom-purpose devices based on the application of an age-old mechanical principle is seeking opportunities to broaden its capability and product applications. Through periodic Current Awareness searches and manual searches in areas beyond the data currently available through the computer this client company president is being assisted in his effort to be the most knowledgeable man alive with respect to possible uses for his product and applications for the principle it utilizes. He has stated that he is "willing to put in much time in analyzing" any and all leads which will broaden his library and his understanding of applications and technology.
10. Indicative of other client satisfaction are the following comments, taken verbatim from the correspondence files: "This appears to be a very complete search since it includes all the literature references which

I have accumulated on my own (and then some!)."

". . . your search appears to have produced interesting references that I would not otherwise have found."

"I am impressed by not only the number of references but their quality. It seems to me that your service will be utilized for many of our general searches; specific information might be better gained, however, from bibliographies contained in the primary pieces of literature revealed by the search. . . . I think you have done a good job for us."

"May I take this opportunity to state that the results of the two retrospective searches recently conducted for us by NERAC have greatly surpassed our expectations."

A few of the features of the NERAC service which we particularly appreciated are listed below:

1. A high percentage of the references located proved most useful.
2. The fact that NERAC furnished reprints of articles requested saved us considerable time and effort.
3. Service has been prompt and well organized.
4. Useful technology from other industries or disciplines has been made available to us in time to help us with the solution of specific immediate problems.
5. The additional references supplied us by NERAC's applications specialists have also proved most helpful.

Perhaps the easiest manner in which to summarize our opinion of the services afforded by NERAC is to state that as future needs arise we will continue to look to NERAC for assistance in obtaining information required for the solution of specific problems."

"This is exactly the type of information which is proving your program to be so worthwhile for us. We appreciate what you are doing for us, and look forward to our continued relationship."

"Your search is beginning to pay off."

"I am well-pleased with the coverage-area of the search, for many of the more distantly-related items have turned out to be of direct interest to our engineers involved in various other projects. I

don't mind the inclusion of the more marginal items; besides, through distribution here, they may generate more business for you."

"We enjoyed our relationship with your . . . applications specialist, and . . . technical specialist. The information they have provided thus far is proving to be most interesting and helpful."

"It is probable that this search will be used with the company as an example of NERAC capability. Your cooperation and assistance is greatly appreciated."

"The report actually serves two purposes. First, it keeps us from wasting R&D and duplicating the work of others. Second, we can usually tell who is interested in our sort of product by noting where the research money comes from and how much of it there is."

"We've received our first report on electro-optical monitoring systems and it's quite useful.

.
Many sources of valuable information are so obscure that they're only available for the first time from NASA, and a minor fact can make all the difference in a business like ours."

"It takes only a week or so to top off a man's education in a narrow field. All he has to do is read through the binders of abstracts NASA sends us, perhaps requesting a paper or two of special interest.

.
And I specifically like the heavy amount of European and Japanese material available. Often, something like 30% or 40% of a binder may have overseas data that would otherwise be hard to obtain and translate."

11. Search services performed for members of the faculty of the University of Connecticut and sponsored by the University of Connecticut Research Foundation is somewhat of a special project of more than average interest. The response, result and evaluation of the services provided are also above average. A report of the project is attached in Appendix B, page 62.

Since proper documentation of all client contacts by NERAC representatives must be maintained for effective marketing performance and control purposes, this documentation can and does provide a means for study of the transfer/utilization process. It appears significant, too, that the information which is important to NERAC in building a clientele and to NASA in support of its technology utilization efforts in the short run is the same

information which can do so much for the growth of the civilian economy in the long run.

These capsule summaries and the company and contact information upon which they are based afford us only a meager start in attempting to find answers for such questions as what steps are, or are likely to be, involved in the transfer and utilization process? What are the characteristics of firms or organizational components which should be sought as high potential vehicles for effecting this transfer? In the words of Rostow, what are the "pre-conditions for take-off" for technology transfer; what are the characteristics of the "take-off" or transfer process; and what is the "drive for maturity" which characterizes the continuing and effective use of third party findings and documentation?

The start NERAC has made as its first step in a planned program to find some of the answers to these questions includes:

- a. the assignment of a responsibility for documentation as an "additional duty" to a member of its staff;
- b. the preparation of a check-list (See Appendix C, page 83) of items about each client which should be secured by the Applications Specialist as appropriate in the course of his contacts with his client -- the questions result in added information for the client file, and often suggest added approaches to the client which the applications specialist may use;
- c. the "case" man reads client file folders periodically and talks with the applications specialists about the information, its implications, the applications specialist's progress with the client and the responses of the clients' personnel, etc.; and
- d. he attempts to write summaries or "cases" of the work with various clients as their progress (or termination of the use of searches) indicates an opportunity.

V. GENERAL OBSERVATIONS, CONCLUSIONS AND FUTURE TRENDS.

The experience and teaching of the first year of operation has posed a number of questions about NERAC's objectives, responsibilities and modus operandi.

1. To what extent should the thrust of the drive for self-sufficiency be directed towards the public, the 'non-profit' and the academic institution as opposed to the industrial sector since such institutions seem most sympathetic, both conceptually and financially, to the NERAC service.
2. To what extent is NERAC's aim the satisfaction of the customer or the education or re-education of the customer? Is it likely that there will be any quantitative measure of this satisfaction in terms other than repeat orders?
3. Is it possible and advisable to place defined limits on the extent to which NERAC should go to achieve customer satisfaction and/or customer education?
4. What are the bases on which the limits referred to in #3 above can be imposed? For example one basis is geographical; should this be confined to New England? Another basis is subject matter; should this be limited to the NASA tapes? A third basis is effectiveness; should NERAC confine itself to those fields in which experience will increasingly demonstrate more than average competence? A fourth basis is associated with the differing motivation for inquiry of the potential client. NASA Contractor Report CR-790 refers to this in stating (p. 15) ". . . every individual's information-seeking activity has multiple dimensions." In a subsequent footnote this point is enlarged.

"Menzel, elaborating on the work of Voigt, suggests five dimensions: (1) the current approach, motivated by

the need to keep up-to-date with one's field; (2) the everyday approach, which demands information for the specific task at hand; (3) the exhaustive approach, which calls for covering all the relevant information in a field (usually done prior to the start of a new project); (4) the brush-up-on-a-new field approach, that is, an area not previously attended too closely; and (5) browsing outside one's predefined area of attention approach. Menzel suggests that the first three should be further categorized by whether the individual is seeking information about data and results, or methods and procedures, or theoretical concepts; and by whether the information sought is within one's own field or some other field. Herbert Menzel: "The Information Needs of Current Scientific Research." The Library Quarterly, vol. 34, Jan. 19, 1964, pp. 4-19."

It is conceivable that pay-off could be optimized by a restriction of activities based on these distinctions, suitably refined for NERAC's audience in the light of increasing experience.

5. Is there a basis for determining the retrieval/referral mix in any particular situation? What is the retrieval level below which it becomes mandatory to include additional, extra-mural retrieval and/or referral? Alternatively what is the referral level above which it is unnecessary to give any retrieval? These questions do not confuse the use of the terms "retrieval" and "referral" insofar as "references" are "retrieved". They pertain to the actual provision of hard copy and/or live bodies as opposed to referring to them.
6. To what extent should NERAC attempt to anticipate demands for extra-mural information by instituting now a "retrospective search" and "current awareness" program of its own in its own field? This would, of course, apply not only to a large or small collection of appropriate subject areas as may seem necessary, but also to the theory and practice of I.S. & R. and Technology Transfer and Utilization. If this is done, is it feasible to mechanize the storage for subsequent retrieval, of the results? In effect, is it sensible to envisage the creation of a NERAC tape?
7. Since there is a good deal of what appears to be overlapping activity in Connecticut, in NERAC's so-called field, to what extent should NERAC cooperate with these other efforts, (in some instances to its own detriment) and to what extent would it be advisable to attempt to coordinate them or indeed, dominate them? If too many independently operating groups are active, there is a risk of audience satiation which would operate to NERAC's

disadvantage. On the other hand, is the proper view of this one which sees the situation as a classic one of free competition with satisfaction of the market place the ultimate criterion of success? In this case can we afford to improve our competitive standing? Or alternatively, how can we not afford to improve our competitive standing?

8. To what degree is it considered that, in addition to retrospective and current awareness services associated in some relevant manner with existing activities of clients and potential clients, some kind of "future awareness" service might be found of value? What forms could a "future awareness" service take, particularly if it should not or cannot be "relevant" in the same sense that the Retrospective Search and Current Awareness services are?
9. Is it generally considered not feasible to have an information service which does not involve face-to-face contact?
10. Is it advisable at this early stage of NERAC's existence to envisage extensions to the type of service offered and therefore to the basis for payment? One example of such an extension would be the provision of general consulting services in the information field at a given hourly, daily, weekly or monthly rate. To do this of course raises the question of a competence to do it. It also raises the question of what is the information field.
11. How far do "special projects"--even those closely enough related to NERAC's basic function, so as to come within the scope of the NASA contract--have to be self sustaining financially? Alternatively, to what extent can funds from the existing contract be allocated for this purpose since the contract is presumably a "cost reimbursable" one.
12. Would it in any sense be considered unethical to look for other clients who might be persuaded to buy the results of a particularly fruitful search for an earlier client? There are certain kinds of searches that might find multiple application in a non-competing sense.

Partial answers to some of these questions can be made. Others require further experience before any sensible response can be given.

Although NERAC's Advisory Committee has recommended an apportionment of effort as between the private and public sectors, it is salutary to indulge in a speculation, the basis for which is, in the short term, somewhat contrary to the Advisory Committee's view.

One feature of the NERAC experience during the first year of operation is the reluctance of industry to accept the concept that not looking at externally generated technology on a continuing basis, at least as a form of insurance, should be anathema to industrial thinking. The same inhibition is conspicuously absent from the public and academic sectors. The success of searches for the University of Connecticut faculty testifies to this.

To date, funding for 120 faculty and faculty-type searches has been obtained; little NERAC effort was involved, and all of the effort aimed in the direction of acquiring funding for faculty searches has been successful. The effort in this direction is being continued, so that it is very reasonable to assume that 250 searches from new clients (States other than Connecticut, Universities other than the University of Connecticut) will be secured during the coming year, and that this figure can be doubled in the year following.

A modest figure of 100 searches is the expectation for the coming year for new searches funded by the University of Connecticut or the Connecticut Research Commission (in this connection the Wilbur Cross Library has already requested a proposal from NERAC, and departmental interest is high). On these bases, it is believed that a total of 800 search requests from faculty members in Universities throughout the New England area for the year April 1969 to April 1970 is a reasonable one.

In addition, so far as the industrial sector is concerned it can be assumed that, even without the conventional and somewhat unrewarding 'face-to-face' selling effort alluded to elsewhere, existing clients will place orders in the coming year for as many searches as have already been performed for them; and that advertisements, articles and referrals will produce 100 or so new search requests. A goal of twice as many searches from new clients is estimated to be reasonable for the year 1969-1970.

It is possible to envisage, therefore, that a goal of 100 search requests a month, (66.6% from faculty members), could be established for the year 1969-1970. If this goal is surpassed, the income for that year could be in excess of \$180,000. This amount could cover the complete costs associated with the information search function, and furthermore, could make a contribution towards university and industrial client relations and marketing activity, which will assure NERAC of continued rapid growth.

Turning now to NERAC's aim, it is generally agreed that customer satisfaction is the main goal. This has several implications, one being the extent to which the present data base is satisfactory for this purpose. Experience has shown a continuing need either to expand or to go outside the present data base because of the wide diversity of 'client's' needs and expectations. As a result of this, the information resource on which NERAC can

rely is increasingly hybrid in character and is growing in coverage to meet this growing diversity of industrial needs. It essentially comprises:

1. A computer-based data bank giving precise and expeditious access to 250,000 documents, growing at a rate of 5000-6000 documents per month. These cover a broad spectrum of subjects relating to aerospace science, technology and management.
2. A widening network of specialized information services existing elsewhere in the United States, both computer based and conventional, with which NERAC has intimate working relationships.
3. Conventional and comprehensive library resources within the University of Connecticut library with which NERAC again has a very effective working relationship.

The excellence and efficacy of the in-house 1401 computer which is the keystone of the computer based data bank, goes without saying. It has been able to perform all routine searches with ease. In fact it has been able to facilitate the activities of sister Regional Dissemination Centers by performing retrospective searches for them. However, the 1401 does not lend itself to information retrieval research leading to an improved Regional Dissemination Center retrieval service because it does not have any compiler level language. Now that it has been shown that an in-house computer improves Regional Dissemination Center performance, efforts to show how a machine with better programming features would affect a Regional Dissemination Center's operation have been initiated.

The extent to which the search facility has a hybrid characteristic is illustrated by the listing of additional information sources used during the year in Appendix B, pages 80 and 81.

Questions involving a desirable retrieval/referral mix have not received much attention during the year. There have been one or two examples of referral of 'clients' to NASA Field Centers, and, more particularly, individual research workers located there. Insufficient experience makes any observation imprudent.

The overlapping nature of the activities of other organizations and institutions in NERAC's sphere of influence has been dealt with, almost exclusively, by adopting a posture of cooperation. This will continue to be the case.

Extensions to the basic service which NERAC offers have been found acceptable and useful to a handful of 'clients' but again, experience of this is limited and no conclusions can yet be made. One interesting aspect of this is the evident wish of some State Technical Services Act authorities to buy searches from NERAC's

existing stock. Another aspect is the creation of a product which is unequivocally based on aspects of the content of the computer data base. This product will be state-of-the-art surveys of particular fields of current and preferably public interest. One example is 'Sonic Boom'. The computer will identify documents and a package will be made up consisting of a computer print-out, a selection of abstracts and several documents. This package will be offered for sale to interested buyers, not necessarily confined to the academic or technological community.

From all this, it is fair and reasonable to contend that the New England Research Application Center is proceeding in an intelligent, forceful and innovative manner towards its goals; that there remain no reasons to believe that, in the light of lessons learned during its first year of operation, it cannot achieve its twin aims of self sufficiency and community service within a total period of three years and that NASA's continuing faith in the Regional Dissemination Center concept will ultimately achieve the sanction of public approbation.

APPENDIX A

**IMPROVING EFFECTIVE UTILIZATION OF INFORMATION
IN TECHNICALLY BASED ORGANIZATIONS**

- IMPROVING EFFECTIVE UTILIZATION OF INFORMATION
IN TECHNICALLY BASED ORGANIZATIONS

Science and technology have become the subject of a growing National interest over the past several decades; not only are present and potential accomplishments of interest, but questions of goals, indirect effects of technical change and effectiveness in resource utilization are of great concern. A more recent development is a substantial interest in achieving the best possible society-wide payoff from our substantial investments in such fields. The most obvious means to increased payoff is by achieving more general utilization of the knowledge derived from advanced scientific and technical programs. Commercial and governmental interests and programs in technology transfer represent a direct attempt to promote such an increase in effective utilization.

A principal finding of recent studies in technology transfer is that a management gap, as much as any other factor, impedes progress in more effective information utilization. There is a great disparity in management skills between the few organizations which excel in effectively adapting new technology and the much larger number of organizations who might profit from such expertise. As a recent Congressional study, concerned with policies for improving technology transfer concluded: Economic growth does relate to technical change but business problems...often may not be analyzed so that technical solutions are recognized...A technology transfer program, therefore, must include...(among other things)...counseling for need recognition where the firm may be small or unsophisticated."*

* U.S. Senate. Policy Planning for Technology Transfer. Ref. (39), page 1.

The present report and the seminar which it outlines directly addresses the problem of need recognition. It seeks to promote more effective technology transfer by developing in the participants, and, consequently, the organizations they represent, improved understanding of factors which lead to an effective utilization of information in a goal oriented organization.

We can promote more effective industrial use of technical information even though our understanding of the transfer process itself is still imperfect. We find ourselves in the position of the practicing physician. He does not completely understand the cause of an illness, but he does understand enough to help the patient. So we believe that effective information utilization can be promoted by improving policy and organizational climate so that they are conducive to effective transfer and utilization. The program we propose is a series of seminars for technologists, managers and other individuals in a position to benefit from a better understanding of information utilization. More specifically, suggested participants would include the following:

Suggested Participants

- a. Managers of Engineering and Research functions within industry and government
- b. Managers and professional staff concerned with new product, marketing strategies and idea generation.
- c. Present and aspirant entrepreneurs and industrial analysts who are interested in prospects for innovative technology as it is influenced by technology transfer.

Learning Objectives

The learning objectives of the seminar are in the spirit of recent findings which have grown out of studies concerned with technical transfer. As a recent government panel on Invention and Innovation concluded: industries backward in innovation can learn from those that are progressive.* Consistent with these findings, the seminar is founded upon the objectives of improving the use of new technical results in the scientific and engineering based organization, through:

- - an improved understanding of the technological innovation process and the factors which stimulate and retard this process.
- - a deeper insight into the paths of information transfer and their relevance to organizational objectives.
- - purpose and selectivity in structuring the organization's information links.

The seminar will be conducted so as to foster close intellectual association and discussion among participants. Thought provoking literature, selected reference material and cases which raise critical issues and serve to illustrate relevant concepts will be used as course material. The purpose of this learning environment is not only to stimulate learning from the instructors and reference material but also learning from the experience of others who are present.

The separate learning units which make up the seminar are outlined next. Target learning objectives in greater detail are proposed

* A Panel on Invention and Innovation headed by Dr. Robert A. Charpie, president of the Electronics Division of Union Carbide Corp. The panel was named by Secretary of Commerce, John T. Connor. (Ref. Fortune, August, 1967, p. 136.)

for each of the five units. Following the learning objectives is a Pedagogical Outline with suggested course material. In this outline, more thorough background and reference material is separated from thought provoking material suggested for reading by participants. This latter material is selected to present principal issues for discussion. Cases, and questions for directing case study, are suggested along with a general statement as to how literature may be used in conjunction with case material.

SEMINAR APPROACH AND CONTENT

The seminar includes both factual and conceptual material as well as cases which relate this to the practical realities of management within the operating organization. The teaching approach is planned so that material is presented by two different methods throughout the seminar and integrated together in conclusion. Cases are used to involve participants in actual problems, similar or related to those which they face in their own organization. Against this background of specific, familiar problems which require answers, the source literature is presented and discussed. By such a dual approach it is possible to relate specific findings and concepts in terms of problems that are very real and meaningful to the participants. In addition, careful analysis of the cases reinforces the applicability of selected material since the pattern of influential factors are brought out in an historical study of an organization's effort in innovation.

The learning objectives of the seminar are outlined below. These are not necessarily time phased with the seminar, however. They represent a different way of categorizing the material covered, and may be presented through selected readings by the seminar instructors or represent the conclusion of skillfully guided group discussion.

I Nature of the Innovative Process

The fundamental purpose in fostering technology transfer is to achieve an overall improvement in technological innovation. We must look to innovations in new techniques, processes and products as meaningful payoff from such increased knowledge. The first learning experiences sought will be those which can be gained from studying innovations and the innovative process. The organizational climate as it stimulates or suppresses technical change; patterns of individual behavior as they are associated with innovation; market and financial considerations and the implications which arise from the changing nature of technical effort, are principal issues considered in this learning unit. The principal learning objectives in outline form are:

- a. Resistance to change and characteristics of successful innovations.
- b. Critical uncertainties and risks in innovation.
- c. Institutions of society and the economy and their influence, patent policy, capital formation, government policy and economic factors.

II Payoff from Technological Progress in the Operating Organization

Organizational objectives in technology transfer are appropriately based upon a good understanding of both the benefits which may be anticipated from such a program and the consequences of failing to achieve effective infusion of new knowledge. Spectacular results will not usually represent the most important form of payoff, however. The most significant benefits may stem from many incremental improvements arising from new knowledge. These may affect lower process costs, new products or improved products. The results sought will depend upon the characteristics of the organization and its environment, but programs for improved technology transfer should recognize subtle but important returns as well as spectacular results. Furthermore, they should be based upon realistic objectives for a particular organization rather than a stereotype which may do more harm than good. Specific topics in this section include:

- a. Role of new and improved products in policies for growth and survival.
- b. Economic gains from research, new product development, product improvement and progress development.
- c. The characteristics of successful ideas.

III The Technology Transfer Process as We Know It

Technology transfer takes place in many different ways.

A source useful in scientific investigation will not be useful to an engineer facing an exigent problem in the same field. Both may be relevant to an organization's goals. The burgeoning literature of all fields emphasizes the need for selectivity in effecting an efficient match between needs and sources.

Although we have only partial understanding to guide efforts in matching needs with sources, it is useful to consider that knowledge which is available and relevant. With this purpose in mind, it is appropriate to explore the variables which relate and serve to influence actual patterns of information acquisition. Such knowledge can assist in an effort to structure useful policies for technology transfer. Specific distinctions which discriminate as to usage are as follows:

- a) User traits and their influence - Scientist vs. Engineer
- b) Intended information use and its relevance to transfer.
- c) The organization's motivation to withhold or communicate - Window into science vs. proprietary considerations
- d) Organizational size make-up and goals as they influence transfer.
- e) Geographical location

IV : Concepts Which Explain Aggregate Patterns in Information Transfer: Toward Predictive Models for Management's Use

Recently, several explanatory descriptions - descriptive models - of the technology transfer process have been proposed. These seek to explain the patterns of transfer which are experienced in practice. At the same time, they can offer the manager a means of predicting the consequences of particular policies and courses of action. While these models are still tentative, they may serve a most practical purpose in identifying the broad range of factors and their interactions as they relate to technology transfer policies. We propose to critique several different models and test their relevance to actual case situations.

- a) Separate scientific and separate technological semi-closed information networks which challenge the manager in achieving their union.
- b) Information Policy Models for effective utilization within the firm - Relating an organization's exterior information couples with markets, science and technology, to the internal two way information transfer process which promotes utilization.

V Converting Concepts and Implications to Managerial Action

Current knowledge and concepts concerning technology transfer have value only as they influence more effective utilization of science and technology. They must have meaning to the manager and provide better guidance for him in making decisions and formulating policies. New knowledge which could lead to more effective management often goes unused because its relevance to practical day to day problems is not recognized.

This gap can be closed through effective material presentation. Skillful integration of cases into a seminar program can serve this objective; cases which describe actual operating situations, decisions and outcomes. By this means, the relevance of an improved understanding of technology transfer to actual managerial action can be demonstrated and future use of such an understanding further promote. The final learning objective of the seminar is to achieve better future implementation of the knowledge acquired during the seminar and cases are integrated into the program for this purpose.

PEDAGOGICAL OUTLINE AND COURSE MATERIAL

I Learning Unit I Nature of the Innovative Process

- 1) Teaching Method - Literature Readings, Discussion with Case analysis as a vehicle for clarifying the impact of the relevant factors.
- 2) Selected Student Readings:
Barnes: "To Promote Invention"
*Bright: "Opportunity and Threat in Technical Change"
Eaton: "Patent problem: Who Owns the Rights"
*Lorsch: "Organizing for Product Innovation"
McLaurin: "The Process of Technological Innovation"
*Morison: "A Case Study of Innovation"
Schon: "Champions for Radical New Inventions"
- 3) Case Discussion Material
Photon (A,B,C,D,E and Crossfield and Zipp)
- 4) Question for Discussion: Should the new development be undertaken? What information is relevant to this decision?
- 5) Additional reference material citations. (6t,22,27,30,38)**

II Learning Unit II Payoff from Technological Progress, in the Operating Organization

- 1) Teaching Method - Literature reading and guided discussion by instructor.

* Material selected for use in Appendix A¹ Tentative Seminar Schedule.

** References with a "t" may be found in Appendix A¹ others in Appendix A²

2) Selected Student Reading -

*Schmookler: "Changes in Industry and in the State of
Knowledge as Determinates of Industrial Invention"

*Quinn: "Long Range Planning of Industrial Research"

Wells and Waterman "Space Technology Payoff from Spinoff"

3) Question for Discussion: Reconcile to your own satisfaction the benefits which a 'manager' must look to as justification for increasing the technological expertise of his organization in light of Quinn's and Schmookler's articles. Specifically, reconcile the following comments:

Schmookler: "Scientific discoveries played no appreciable and obvious role in triggering important inventions in our four industries."

Quinn: "Developing the right technology at the right time is now a critical competitive consideration for most companies."

(The Wells and Waterman article may be used in place of Quinn.)

4) Additional Reference Material: (7,18,23,30,32,38,39)

III Learning Unit III The Technology Transfer Process as We Know It

1) Teaching Method: Literature Readings and Discussion with Case analysis as a vehicle for clarifying the impact of the relevant factors.

2) Selected Student Readings:

*Rosenbloom and Wolek: (Chapters 3 & 4) Technology,
Information and Organization

Gilmore: The Channels of Technology Acquisition in
Commercial Industry

3) Case Discussion: *International Instruments, Inc.,

Questions for Discussion:

Identify and Evaluate the effectiveness of the principal information sources in the International Instruments case, as they contribute to the firm's capability as an innovative organization. If you owned stock in this company what changes would you recommend?

4) Additional Reference Material: (3,6,8,10,11,12,14,15,19, 20,21,33,34,35,37,38 and 39).

IV Learning Unit IV Concepts Which Explain Aggregate Patterns in Information Transfer - - Toward Predictive Models for Management's Use.

1) Teaching method: Literature Readings and Discussion, and Case Discussion. Case discussion is used to explore the relevance of concepts in explaining outcomes.

2) Selected Student Readings:

Rosenbloom: Product Innovation in a Scientific Age

*Rosenbloom and Wolek: Chapter 5, Technology, Information and Organization

Morton: "From Research to Technology"

Morton: "The Microelectronics Dilemma"

3) Case Discussion Material:

*Dewey and Almy Chemical Division

Question for discussion:

Analyze the process by which the new "blanket" became an economic reality. What factors or policies might facilitate or speed this process. What can be done to improve innovative effectiveness?

- 4) Additional Reference Material: (17,26,29,30,39)

V Learning Unit V Converting Concepts and Implications to Managerial Action

- 1) Teaching Method: Principally the case method with emphasis upon the action prerogatives which management can exercise in improving relevant information couples with the frontiers of technology and the market place. Selected readings may be used to provide focus.

- 2) Selected Readings:

Myers; Industrial Innovations and the Utilization of Research Output

Quinn: Long Range Planning of Industrial Research

- 3) Material for case discussion:

*Solotron I and II

Promethean Corporation

Questions for discussion:

Analyze the information transfer process as it exists in the company. What action do you recommend to improve the long run effectiveness of each organization?

- 4) Additional Reference Material: (29)

APPENDIX A¹

Selected Readings Suggested for Use by Students

- 1t) Barnes, Carl E. "To Promote Invention," International Science and Technology. December, 1966. Stress is placed here on organizational environment which is useful in fostering invention or innovation. The rigidity possible in an organization itself is treated as a principal barrier.
- 2t) Bright, James R. "Opportunity and Threat in Technical Change," Harvard Business Review. This article summarizes principal difficulties experienced by organizations in using new technology. The viewpoint taken is that of the manager who must reach such decisions.
- 3t) Eaton, William W. "Patent Problem: Who Owns the Rights," Harvard Business Review. July-August, 1967, pp. 101-110. A discussion of the issues which are involved in patent policy for new inventions. Particular emphasis is placed upon innovations from Federally sponsored R & D programs.
- 4t) Gilmore, John S., et.al. "The Channels of Technology Acquisition in Commercial Industry and the NASA Dissemination Program," Denver Research Final Report; NASA Contract 06-004-039; Denver Research Institute, 1966. A comprehensive description of the manner in which technical information is communicated in industry. The implications for technology transfer policy are also discussed.
- 5t) Lorsch, Jay W. and Paul R. Lawrence, "Organizing for Product Innovation," Harvard Business Review. Jan-Feb., 1965, pp. 109-120. This article reports conclusions from a study of relationships between R & D groups and other organizations in several companies. Factors which relate to successful organization are discussed particularly in respect to the need for differentiation between R & D and other departments.
- 6t) Maclaurin, W. Rupert. "The Process of Technological Innovation: The Launching of a New Scientific Industry," American Economic Review. March, 1950. A well documented study of the radio industry from its beginning until it was well established. Emphasis is on the inventor and innovator in this process. Well supported conclusions as to individualistic, organizational and economic patterns are drawn from this historical perspective.
- 7t) Morison, Elting E. "A Case Study of Innovation," Engineering and Science Monthly. April, 1950. This article is a second historical study of a particular innovation - continuous aim firing for naval ships - by an historian. This study emphasizes organizational problems in overcoming resistance to change and the situational factors which influence innovation.

- 8t) Morton, Jack A. "From Research to Technology," International Science and Technology. May, 1964, pp. 82-105. Drawing upon experience with Bell Laboratories, the article suggests necessary flow of information to and from research laboratories. The emphasis is on organizational arrangements between organizations within a large corporation.
- 9t) . "The Microelectronics Dilemma," International Science and Technology. July, 1966, pp. 35-44. This represents a continuation of the previous theme; but emphasizing the implications which two trends raise: an accelerating rate of technological change and the increasing need for interdisciplinary exchange among many people. Management patterns in transistor development are compared with microelectronics to illustrate increasing involvement of more different individuals in a single element. Implications for organization are drawn.
- 10t) Myers, Sumner. "Industrial Innovations and the Utilization of Research Output," Paper presented before the 'National Conference on the Administration of Research, University of Florida, October, 1966. A paper which serves to integrate separate research results concerning technology transfer, behavioral studies etc. to the problem of facilitating the use of new technical knowledge.
- 11t) Quinn, Brian. "Long-Range Planning of Industrial Research," Harvard Business Review. July-August, 1961, pp.88-102. This article is an overview, addressing the problem of integrating R & D with overall organizational goals. It establishes a framework within which technical, market and financial operations may be related.
- 12t) Rosenbloom, Richard S. and Francis W. Wolek. Technology, Information and Organization: Information Transfer in Industrial R & D. Boston: Harvard Business School, June, 1967. Chapters 3 and 4. These chapters present the characteristics of technology transfer based on many incidents of transfer elicited from over 3,000 engineers and scientists. Differences in transfer depending upon information use, personal traits, organizational context, etc. are emphasized.
- 13t) . Technology, Information and Organization: Information Transfer in Industrial R & D. Chapter 5. This chapter synthesizes the results of the previous study with the conclusions from other literature sources and studies into a descriptive explanation of both scientific and operational (technology), information transfer. The managers' effectiveness in usefully integrating and turning both information transfer systems to organizational goals is described as an important aspect of successful management.

14t) Schmookler, Jacob. "Changes in Industry and the State of Knowledge as Determinates of Industrial Invention," The Rate and Direction of Inventive Activity. Princeton: Princeton University Press, 1962, pp. 195-231. This article represents conclusions of a study into factors which stimulate industrial invention. Results show that economic factors seem to lead and provoke invention. It suggests the importance of economic considerations in affecting a match between technological advances and needs.

15t) Wells, John G. and Robert H. Waterman. "Space Technology: Payoff from Spinoff," Harvard Business Review. July-August, 1964. These authors emphasize the possibility of obtaining successful technology transfer from government programs into the private sector. Conditions for success are described in terms of actual organizations which have benefited from such transfer.

APPENDIX A2

Reference Material

- 1) Alcot, James, "Technology Transfer via a Research Institute," Research/Development, Sept., 1966.
- 2) Allen, T.J. "Studies of the Problem Solving Process in Engineering Design," IEEE Transactions on Engineering Management, vol. EM-13, 1966, pp. 72-83.
- 3) _____ and S. I. Cohen. "Information Flow in an R & D Laboratory," Working Paper 217-66; Sloan School of Management, Massachusetts Institute of Technology, 1966.
- 4) American Psychological Association. Reports of the American Psychological Association's Projects on Scientific Information Exchange in Psychology, Washington, D. C.: American Psychological Association, vol. 1, 1963; vol. 2, 1965; vol. 3, 1966.
- 5) Auerbach Corporation, "DOD User Needs Study, Phase I," Final Technical Report, 1151-TR-3, 2 vols., Philadelphia: May, 1965.
- 6) Bauer, R.A. "The Obstinate Audience," American Psychologist, vol. 19, 1964, pp. 319-328.
- 7) Butz, J.S. Jr. "Are Research and Technology Outgrowing Free Enterprise," Air Force Magazine, Nov., 1964.
- 8) Crawford, J. H., G. Abdian, W. Fazar, S. Passman, R.B. Stegmaier, Jr. and J. Stern. Scientific and Technical Communications in Government. Task Force Report to the President's Special Assistant for Science and Technology; April, 1962, (AD-299-545).
- 9) Cuadra, C., (editor). Annual Review of Information Science and Technology. vol. 1; New York: John Wiley, 1966.
- 10) Egan, M. and H.H. Hinkle. "Ways and Means in Which Research Workers, Executives and Others Use Information," Documentation in Action. J.H. Shera, A. Kent and J.W. Perry (editors), New York: Reinhold, 1956.
- 11) Glaser, B.G. "The Local-Cosmopolitan Scientist," American Journal of Sociology. vol. 69, 1963, pp. 249-59.
- 12) Glass, B. and S.H. Norwood. "How Scientists Actually Learn of Work Important to Them," (ICSI); vol 1, Proceedings of the International Conference on Scientific Information; Washington, D. C.: National Academy of Science, 1959, pp. 195-197.

- 13) Hanson, C. W. "Research on Users' Needs: Where is it Getting Us," Aslib Proceedings, vol. 16; 1964, pp. 64-78.
- 14) Herner, S. "Information Gathering Habits of Workers in Pure and Applied Science," Industrial and Engineering Chemistry. Jan., 1954, pp. 228-36.
- 15) . "The Information Gathering Habits of American Medical Scientists," ICSI. 1959, pp. 277-85.
- 16) Holloman, Herbert J. "Technology Transfer," Address before the Conference on Technology Transfer and Innovation, National Planning Association; Washington, D.C.: May 16, 1966.
- 17) Lawrence, P.R. and J.W. Lorsch. "Differentiation and Integration in Complex Organizations," Administrative Science Quarterly. vol.12,no.1; June, 1967, pp.1-47.
- 18) Leshner, R.L. and George J. Howick. "Assessing Technology Transfer," NASA SP-5067: National Aeronautics and Space Administration, 1966.
- 19) Menzel, H. "The Information Needs of Current Scientific Research," Library Quarterly. vol. 34; 1964, pp.4-19.
- 20) . "Scientific Communication: Five Sociological Themes," American Psychologist. vol. 21; 1966, pp.999-1004.
- 21) . "Can Science Information Needs be Ascertained Empirically?" Communication: Concepts and Perspectives. Proceedings of the Second International Symposium on Communication Theory and Research; Lee Thayer (editor), Washington: Spartan Books, 1966.
- 22) Myers, Sumner. "Industrial Innovations: Their Characteristics and Their Scientific and Technical Information Bases," National Planning Association; April, 1966.
- 23) Nelson, Richard, Merton J. Peck and E. Kalachek. Technology, Economic Growth and Public Policy. The Brookings Institution; Washington, D. C.: 1967.
- 24) President's Science Advisory Committee. Science, Government and Information. Washington, D. C.: U.S. Government Printing Office, 1963.
- 25) Price, D.J. de S. Little Science, Big Science. New York: Columbia University Press, 1963.
- 26) . "Is Technology Historically Independent of Science?" Technology and Culture. vol. 6; pp.553-68, 1965.

- 27) Rogers, E. M. Diffusion of Innovations. New York: The Free Press, 1962.
- 28) Rosenbloom, Richard S. and Francis W. Wolek. Technology, Information and Organization: Information Transfer in Industrial R & D. Boston: Graduate School of Business Administration; Harvard University, June, 1967.
- 29) . "Product Innovation in a Scientific Age," New Ideas for Successful Marketing. Proceedings of the 1966 World Congress; Chicago: Americal Marketing Association, pp. 247-259.
- 30) Schmookler, Jacob. Invention and Economic Growth. Cambridge: Harvard University Press, 1966.
- 31) Seitz, T. "Science and the Space Program," Science. June 24, 1966.
- 32) Shepherd, C.R. "Orientation of Scientists and Engineers," Pacific Sociological Review. vol. 4; 1961, pp. 79-83.
- 33) Sherwin, C.W. and R.S. Isenson. "First Interim Report on Project Hindsight," (Summary, revised Oct. 13, 1966); Washington, D. C.: Office of the Director of Defense Research and Engineering.
- 34) Scott, C. "The Use of Technical Literature by Industrial Technologists," IEEE Transactions on Engineering Management. vol. EM-9; 1962, pp. 76-86.
- 35) and L.T. Wilkins. The Use of Technical Literature by Industrial Technologists. London: The Social Survey, 1960, Revised Edition.
- 36) The Rate and Direction of Inventive Activity. National Bureau of Economic Research; Princeton: Princeton University Press, 1962.
- 37) Taube, M. "An Evaluation of Use Studies of Scientific Information," Documentation, Inc., December, 1958, (AD 206987).
- 38) Tornudd, E. "Study on the Use of Scientific Literature and Reference Services by Scandinavian Scientists and Engineers Engaged in Research and Development," ICSI, 1959, pp. 19-75.
- 39) U. S. Senate. Policy Planning for Technology Transfer. A report of the Subcommittee on Science and Technology; Select committee on Small Business; U. S. Senate, 90th Congress, 1st Session, April 6, 1967. Senate Document No. 15, U. S. Government Printing Office.

APPENDIX A³

Selected Teaching Cases

Dewey and Almy Chemical Division	ICH 6M84
Crossfield and Zip - Harvard Business School Case No.:	T148R
International Instruments, Inc.	ICH 2G96R
Photon A	ICH 7P12
Photon B	ICH 7P13
Photon C	ICH 9P33
Photon D	ICH 9P34
Photon E	ICH 9P35
Promethean Corporation Case	ICH 7M44
Solotron I & II	ICH 4G98

Proposed Teaching Schedule

This schedule is based upon the assumption that the Seminar will be given over two consecutive weekends for two days, Friday and Saturday, each.

	9:00 - 10:15	10:30 - 11:30	11:45 - 12:15	2:00 - 3:30	3:45 - 4:45
Day 1	Introduction to Course and Literature Discussion (Morison - 7t & Bright - 2t)	Study Groups for Photon A	Photon A Case Discussion	Literature Discussion (Schmookler 14t & Quinn 11t)	Seminar Groups Discussion of Participant's Experience in Technological Innovation
Day 2	Photon B, C & D Case Discussion	Literature Discussion (Rosenbloom & Wolek 12 t & Lorsch 5 t)	Study Group for International Instruments, Inc.	International Instruments Case Discussion	
Day 3	Literature Discussion Myers 9 t and Study Groups for Promethean Corp Case	Promethean Corp. Case Discussion	Study Group for Crossfield & Zip	Case Discussion on Crossfield & Zip	Seminar Discussion of Patent Policy Issues (Ref. to Eaton article 3 t)
Day 4	Literature Discussion Rosenbloom & Wolek 13 t	Study Group Solotron (I & II)	Solotron I, II Case Discussion	Discussion on action for Effective Technology Transfer	

APPENDIX B

REPORT ON EXPERIMENTAL
INFORMATION SEARCH PROGRAM

FOR

UNIVERSITY OF CONNECTICUT FACULTY MEMBERS

OVER THE PERIOD 11/1/67 TO 3/31/68

**Report on Experimental
Information Search Program**

for

**University of Connecticut Faculty Members
over the period 11/1/67 to 3/31/68**

On November 1, 1967, the University Research Foundation made a grant of \$2500 to NERAC to perform information searches for Faculty Members of the University.

Thirty-three searches on a broad variety of topics for twenty-seven members of twenty-four different departments have been performed, and data related to these searches is contained in the Appendix attached.

It is submitted that this project has been very successful for a number of important reasons. From the standpoint of the Foundation, the most interesting aspects of the project will possibly be the immediate and widespread response of the Faculty to the announcement that a search service was being made available, and, also, the generally favorable comments received from individual Faculty Members served (see Appendix).

NERAC has gained substantially from the opportunity to perform search activity of an experimental nature, and the lessons learned have had important impact on NERAC's understanding of its own mission and goals. The Project has tended to confirm the need for NERAC to extend its information resources to include tape files of information in-house and/or manual searching of Library Indexes and/or the requisition of searches by Specialized Information Centers.

Further, the project has contributed to a developing collaboration between the Wilbur Cross Library and NERAC, which has lead to exploration of possible ways in which information search

efforts on campus can best be expanded for the benefit of the University and how NERAC/Library activities can best be integrated. Discussions with Chemical Abstracts and the Institute for Scientific Information have been initiated with the possibility of acquisition of tape files from these organizations foremost in mind.

The Information Services section of NERAC acknowledges gratefully the financial support provided, and will be pleased to answer questions on any specific aspect of the Project.

John Miller
Manager, Information Services
March, 1968

Appendix

Topic

Statistical Data on Searches	67
Data on Faculty Searches	68
Faculty Comments	70
Additional Search Requests Received	74
Sample Page of Abstracts	75
Copy of Flyer Soliciting Search Requests	76
Copy of Final Letter Soliciting Comments	77
Copy of Faculty Search Request Form	78
Copy of Faculty Document Order Form	79
Listing of Library Indexes Used by NERAC	80
Listing of Specialized Information Centers Used by NERAC	81
Sample Page of Data on Specialized Information Centers	82

Statistical Data

Number of Searches Performed	33
Number of Manual Searches in Wilbur Cross Library	9
Number of Abstracts Issued	545
Number of Citations Issued	262
Average Number of Abstracts Issued/Search	16.5
Average Number of Citations Issued/Search	7.9
Average Abstract Turn Around Time	22.8 days
Number of Searches for which Other Information Centers Were Contacted	6
Number of Documents Ordered to Date	112
Distribution of Clients by Position:	
Dean	1
Professor	4
Associate Professor	10
Assistant Professor	11
Instructor	4
Total Number of Computer Printouts	37
Total Number of Items on Printouts	5573
Total Number of Strategy Terms	193
Average Number of Printouts/Search	1.1
Average Number of Printout Items/Search	168.9
Average Number of Strategy Terms/Search	5.8

Data on Faculty Searches

<u>DEPARTMENT</u>	<u>NUMBER OF SEARCHES</u>	<u>TITLE</u>
Anatomy (School of Medicine)	1	"Tetracycline"
Animal Diseases	1	"Pathology of Avian Erythroblastosis"
Audio-Visual Center	1	"Psychological Stress"
Basic Science (School of Medicine)	1	"Wernicke's Disease"
Botany	2	"Aristolochic Acid" "Regeneration of Plant Organs"
Chemical Engineering	3	"Plasma Chemistry" "Arc, Plasma, Induction, and High Frequency Heating" "Plasma Arcs and Jets"
Chemistry	3	"Nitrogen-Halogen Compounds" "Absorption of Contaminants in Ground Water" "Polymers"
Child Development	1	"Family Interaction"
Economics	2	"Technological Unemployment" "Economics of Coal Mining"
Education	1	"Heart Disease"
Educational Psychology	1	"Comprehension of Instruct- ions"
Electrical Engineering	2	"Sampled Data Control Systems" "RNA & DNA"
Fine Arts	2	"Architecture and City Planning" "Environmental Control"
Food and Nutrition	1	"Management and Decision Making"
Foundations & Curriculum	1	"Visual Stimulus"
Institute of Public Service	2	"Systems Analysis" "Communication Systems in Public Management"
Mechanical Engineering	1	"Heated Vertical Wall Jet with Buoyancy"

<u>DEPARTMENT</u>	<u>NUMBER OF SEARCHES</u>	<u>TITLE</u>
Pharmacy	1	"Thermodynamics of Surfactant at Air/Water and Oil/Water Interfaces"
Physical Therapy	1	"Neurophysical Effects of Lowering Muscle Temperature"
Plant Science	1	"Disposal & Utilization of Animal Waste"
Poultry Science	1	"Phosphorus Requirements and Utilization of Animal Nutrition"
School of Engineering	1	"High Speed Urban Transporta- tion"
Science Education	1	"Individualized Instruction in Science"
Zoology	1	"Protein Synthesis"

Total Number of Departments	<u>24</u>
Total Number of Search Requests	<u>33</u>

FACULTY COMMENTS

The following written testimonials have been received in response to the request sent out for comments (see page 10):

An Associate Professor in the Institution Management and Foods writes:

"I certainly appreciate the fine listing of articles, abstracts and information which was returned to me as a result of my request for a search. I was amazed at the response, since I had a feeling there would be fewer articles available from the NASA tapes.

The material I received will be used to assist me in the preparation of reading lists for students and to keep me abreast of periodic literature.

In the future, I would be very pleased to have an opportunity to request searches for even more specific titles and abstracts. I would be willing to pay, personally, for this service on a regular basis."

An Assistant Professor in Educational Psychology writes:

"I am extremely pleased with the material you sent to me on 'Stress and Heart Disease.' The information was most helpful in my planning for a new seminar course on Rehabilitation and Heart Disease."

The Dean of Engineering writes:

"I found your search for information on 'High Speed Transportation' most helpful. I wanted to know: What is being planned for urban transportation in the future, and who is doing the planning.

Your search turned up most helpful information in both of these needs. I supplemented this with other information gleaned from other sources, but this was not in print and there was no way that you could have supplied it."

An Assistant Professor in the Department of Economics writes:

"This is a fan letter and a thank you for the research work you did for me. The source listing you sent is most helpful."

An Instructor in Mechanical Engineering writes:

"I wish to express my deep appreciation to you, your staff, and the University Research Foundation, for the fine work done on the literature search 'Heated Vertical Wall Jet with Buoyancy.'

This search has uncovered (and supplied me with) many publications which are pertinent to my work.

I estimate from my past experience that a manual study of this depth would have taken me many weeks.

It is my belief that a great service can be rendered to the academic community by the large scale use of the NERAC facilities, primarily that of increasing the efficiency and productivity of researchers, as well as by reducing the duplication of effort."

An Instructor in Electrical Engineering writes:

"Although the abstracts received did not lead to additional information, they reassured me that my own search was apparently adequate.

The xerox copy of a dissertation which I received was information for which I had no other leads but through your services."

An Associate Professor in Public Services writes:

"I agree and urge NERAC and the Library to fulfill this function...(to establish a centralized information search service in the broad field of science and technology)... My information search needs are in the behavioral sciences (communication), public management and general systems research. Many thanks for your help."

An Associate Professor of Architecture writes:

"My recent requests for your service have been a very modest sampling of the potential value for future assistance. This sampling has proven itself as a highly useful resource. and I would encourage every effort to continually expand it.

The broad scope of science and technology applicable to the fields of Architecture, City Planning and Environmental Design cannot be completely serviced by the Library. There is a future need for current technical references and research in the above fields.

The concept of your service should be fully implemented."

An Assistant Professor of Education writes:

"Thank you for the excellent service on the search NERAC conducted for me on the exploratory project I am conducting on 'Comprehension of Instruction.' I cannot even estimate the many hours your service has saved for me.

We knew, ahead of time, that we could expect few direct studies dealing with this subject, but I did find the bibliographies accompanying several of the reprints provided me quite worthwhile.

I agree that the experience gained from this experiment in information retrieval should be most valuable when added to existing know how, especially that in library science."

A Professor of Anatomy writes:

"In response to your letter of March 7 and with respect to your request for comments on the search work performed for me, I am happy to say the following:

I requested from you information on a highly specialized aspect of research on the drug Tetracycline. I had already made a rather lengthy personal search in the excellent library of the Faculty of Medicine at the University of British Columbia, and had been continuing this search in the equally good facilities here at the University of Connecticut. However, on the basis of the very few key words I offered to you when I made my application for service, you were able to supply me with a number of references of interest, and four of these were of the sort that I might never have come upon, or only after very lengthy and extensive library and inter-library work.

In addition to being certain personally that I would like to use such service perhaps two to five times a year, I have mentioned NERAC to other members of the Health Center faculty. All of them have responded with interest, and have expressed as I do now, the hope that such service at the University of Connecticut may continue, and indeed be broadened in scope."

An Associate Professor of Systematic and Environmental Biology writes:

"In connection with our telephone conversation this morning, I would like to recommend continuation of your services to me in searching for published data on 'Aristolochic Acid and Its Physiologic Effects on High Animals.'

I should also like to urge amplification of your tape-storage banks to include whatever may be available from Biologic Abstracts services, since it appears to me that this is a serious lack in your available information banks.

I feel that NERAC is a valuable addition to the aids available to the faculty and hope that your services may be amplified to permit you to be a truly functional search agency for scientists at the University."

A Professor of Chemistry writes:

"Your searches for me were helpful, uncovering material which I could have retrieved myself only with very considerable difficulty.

I do feel that a continuing dialogue between NERAC and the clients during the course of the searches would be highly beneficial.

It must be realized that although computer based retrieval is valuable it cannot yet supplant manual searching activity."

An Associate Professor of Chemical Engineering writes:

"The search on Plasmas performed for me by NERAC was very helpful. It uncovered several references that are pertinent to my graduate research activities. The procurement of the reports was also appreciated.

Keywords for the search must be carefully selected. The initial search missed some important references because of an incomplete list of keywords. After receiving the results, I also wondered if I might have overlooked other government reports that were not in the tape file.

I hope this service to faculty members will be continued."

The Head of the Department of Poultry Science writes:

"It is a real pleasure to express my appreciation to the New England Research Application Center for the information search which you recently conducted for me. The subject, the metabolism of calcium and phosphorus in the animal body, might at first appear out of your normal area, but the search turned up a number of interesting and very useful publications involving man and other primates.

Ordinarily, these publications would not have come to my attention. They are very appropriate, however, since they involve the same aspects of mineral balance and osteoporosis that we are studying in hens that are laying eggs at a very high rate."

Additional Search Requests Received *

From an Associate Professor of Food and Nutrition on
"Nitrogen Retention"

From an Assistant Professor of Anthropology on "Palaeo-
xenology," (extra-terrestrial archaeology).

From an Assistant Professor of Health on "Cognitive Style
(or Value Orientation) Influencing Computability"

From a Professor of Agricultural Economics on "Optimum
Price Differentials for Milk"

From an Assistant Professor of Music on "Continuing
Education Programs in Fine Arts"

From an Assistant Professor of Physics on "Construction
of Variable Temperature Apparatus for Thermal Con-
ductivity Measurement"

* Requests for which NERAC was unable to perform searches
because of lack of funds.

A68-16528 *

ON THE COSMOLOGY OF ALFVÉN AND KLEIN.

J. H. Hunter, Jr. (Yale University, Astronomy Dept., Yale Observatory, New Haven, Conn.).

Royal Astronomical Society, Monthly Notices, vol. 117, no. 3, 1967, p. 271-274. 11 refs.

Discussion of an approximate treatment of the Alfvén-Klein metagalaxy with a view to determining whether this cosmology could account for the background blackbody radiation in the universe. It is shown that no nonrotating cosmological model of this type would have been able to establish a blackbody radiation field at the epoch of minimum radius and then reexpand to infinity. M.M.

N68-14628*# Smithsonian Astrophysical Observatory, Cambridge, Mass

THE PRODUCTION OF COSMIC GAMMA RAYS IN INTERSTELLAR AND INTERGALACTIC COSMIC-RAY COLLISIONS. 4: GAMMA-RAY PRODUCTION FROM COSMIC PROTON-ANTIPROTON INTERACTIONS

Floyd William Stecker 20 Dec. 1967 35 p refs Sponsored in part by NASA

(NASA-CR-91830, SAO Special Rept.-261) CFSTI: HC \$3.00/MF \$0.65 CSCL 20H

Various cosmological situations are discussed in which the annihilation of antimatter will produce cosmic gamma rays. An upper limit is placed on the amount of cosmic matter-antimatter interaction consistent with recent cosmic gamma-ray observations. It is shown that the production of mesons other than pions have little effect on the annihilation gamma-ray spectrum. It is also shown that gamma rays arising from annihilations at rest have energies between 5 and 865 MeV. The gamma-ray spectrum from annihilations at rest is calculated and compared with the calculations of Frye and Smith. A discussion is then presented of the various

characteristics of proton-antiproton interactions in flight. Production of various mesons, hyperons, and isobars is discussed and cross sections are given. General implications of the data on the resultant gamma-ray spectra are stated. Author

N68-10671# Stockholm Univ (Sweden) Inst of Physics.
HIGH ENERGY NUCLEAR PHYSICS AND ELEMENTARY
PARTICLES Final Report, 1 Jan. 1966-30 Jun. 1967

A G Ekspeng 30 Jun 1967 100 p refs

(Grant AF-EOAR 64-57)

(AFOSR-67-2294, AD-659490) CFSTI: HC \$3.00/MF \$0.65

Contents: Strange particle production in 10 GeV/c proton-proton reactions with two observed strange particles; Experimental results on proton-proton interactions at 10 GeV/c producing six charged particles in the final state; Further investigation of the reaction positive-K + p to K + N + pion in all three charge channels at 3 GeV/c; Strange particle production in 10 GeV/c proton-proton reactions with one observed strange particle; Study of pion-nucleon resonances in proton-proton reactions at 10 GeV/c. TAB

THE NEW ENGLAND RESEARCH APPLICATION CENTER

of the

UNIVERSITY OF CONNECTICUT

DEC 5 1967

SOLICITS

Members of the Faculty of the University

to avail themselves of

INFORMATION SEARCH AND RETRIEVAL SERVICES

These services will be based on the use of the NERAC computerized Data Bank of 300,000 documents covering a broad spectrum of contemporary scientific and technological subject matter.

The usefulness of the Service has already been found to reside in responses to a variety of needs. Some examples are

1. The current need--to keep up with one's field.
2. The everyday need--for information about a specific project or problem.
3. The start-of-a-new-project need--for an exhaustive survey of relevant information in a given field.
4. The brush-up-on-a-new-field need--in areas adjacent to one's specialty.
5. The browsing need.

The service is available without cost through the munificence of the University of Connecticut Research Foundation.

Further inquiries to: Mr. Robert Benjaminson
Extension 1103
Box U-41N

or

Dr. John Miller
Extension 1103
Box U-41N

NEW ENGLAND RESEARCH APPLICATION CENTER

MAIN OFFICE
UNIVERSITY OF CONNECTICUT
STORRS, CONNECTICUT 06268
(203) 429-6616

BOSTON REGIONAL OFFICE
12 ARROW STREET
CAMBRIDGE, MASSACHUSETTS 02138
(617) 876-2840

March 7, 1968

(Copy of Final Letter Soliciting Comments)

You are one of the twenty-seven faculty members for whom we have recently performed information search work under a \$2500 grant from the University Research Foundation.

In this connection, you may find the summarized data on that work, which is enclosed, to be of some interest. You will see that the response to our solicitation for search requests came from a broad spectrum of departmental sources, and that the requests were on a wide variety of subjects.

We originally envisioned that our effort would consist solely of mechanized retrieval from our NASA/AIAA tape file of information on aerospace science and technology, but it became readily apparent as questions were received that, in a number of cases, an incompatibility existed between the information being sought and our tape resource. Rather than reject questions as being inappropriate, we decided to go beyond our in-house data bank and perform, in an experimental way, a modest amount of extramural information searching. This extramural activity has consisted largely of the retrieval of information from specialized information centers throughout the United States, and manual searching in the University Library. Information on these resources is also enclosed.

As a result of this activity on behalf of faculty members over the past three months, we believe now that an important need may exist in the University of Connecticut for a centralized information search service in the broad field of science and technology, and we believe also that, in time, NERAC, in close collaboration with the Library, can ably fulfill this function.

Any comments you might have on the search work performed for you or on how your information search needs in the future might best be met, will be very helpful to us in connection with the final report we will be submitting shortly to the University Research Foundation.

Yours truly,

John Miller
Manager, Information Services

JLM:frf
Enclosures

NEW ENGLAND RESEARCH APPLICATION CENTER
UNIVERSITY OF CONNECTICUT
STORRS, CONNECTICUT 06268

Document Order and Comment Form

Client: _____

Search Title: _____

For Use by NERAC			
Document #	Date Ordered	Date Received	Date Transmitted

Comments: _____

Signature: _____

Date: _____

TITLES OF INDEXES USED BY NERAC

001	Applied Science and Technology Index
002	British Technology Index
003	Monthly Catalog of United States Government Publications
004	Science Citation Index
005	Engineering Index
006	Public Health Engineering Abstracts
007	Bibliography and Abstracts on Electrical Contacts, 1835-1951.
008	Electrical Engineering Abstracts
009	Applied Mechanics Reviews
010	Analytical Abstracts
011	Chemical Abstracts
012	Chemical Titles
013	A.S.M. Review of Metal Literature
014	Metallurgical Abstracts
015	Government-Wide Index to Federal Research and Development Reports
016	U.S. Government Research and Development Reports
017	Dissertation Abstracts
018	Index to American Doctoral Dissertations
019	Brutcher, Henry - Technical Translations
020	Iron and Steel Translations
021	Technical Translations
022	Physics Abstracts, Science Abstracts, Section A.
023	Solid State Abstracts Journal
024	Mathematical Reviews
025	Computing Reviews
026	Information Processing Journal
027	Literature on Automation
028	Documentation Abstracts
029	Meteorological and Geostrophysical Abstracts
030	Oceanic Index
031	Abstracts of Photographic Science and Engineering Literature
032	Water Pollution Abstracts
033	Mineralogical Abstracts
034	List of References on Nuclear Energy
035	Nuclear Science Abstracts

SPECIALIZED INFORMATION CENTERS USED BY NERAC

- 001 Aerospace Materials Information Center Wright Patterson
Air Force Base
- 002 Air Force Machinability Data Center - Metcut Research
Associates
- 003 Defense Ceramic Information Center - Batelle Memorial
Institute
- 004 Defense Metals Information Center - Batelle Memorial
Institute
- 005 Electronic Properties Information Center - Hughes Aircraft
Co.
- 006 Mechanical Properties Data Center - Belfour Stulen, Inc.
- 007 Thermophysical Properties Research Center - Purdue Universit
- 008 Center for Information Services - Akron, Ohio
- 009 Liquid Metals Information Center- Atomics International
- 010 Frost and Sullivan, New York
- 011 National Referral Service, Washington, D. C.
- 012 Institute For Scientific Information - Philadelphia, Pa.
- 013 The Science Information Exchange of the Smithsonian
Institution
- 014 Direct Access to Reference Information (Datatrix), - Xerox
Corp.
- 015 National Oceanographic Data Center - Washington, D. C.
- 016 Nuclear Safety Information Center - Oakridge

SAMPLE PAGE OF DATA ON SPECIALIZED
INFORMATION CENTERS

002

AIR FORCE MACHINABILITY DATA CENTER, Metcut Research Associates

Subject Fields

Data are being processed for all types of materials and for all material removal operations including conventional machining and alternate removal processes.

Collection

The collection of the Center consists of approximately 10,000 documents. The sources of these documents are journals, periodicals, industrial literature, technical and scientific data, Government reports, and technical correspondence. The monthly accession rate is about 300 documents.

004 DEFENSE METALS INFORMATION CENTER, Batelle Memorial Institute

Subject Fields

Principal materials covered by this Center are titanium, beryllium, magnesium, tungsten, molybdenum, columbium, tantalum, stainless steels, hotwork die steels, low-alloy hardenable steels, nickel-base superalloys, and cobalt-base superalloys.

Collection

The collection of this Center, approximately 66,000 items, consists primarily of journals, periodicals, Government reports, industrial literature, technical and scientific data, and technical correspondence. The collection includes classified material. The monthly accession rate is about 400 items.

005 ELECTRONIC PROPERTIES INFORMATION CENTER, Hughes Aircraft Co.
Subject Fields

There are presently nine major categories of materials covered by this Center; semiconductors, insulators, ferroelectric dielectrics, metals, ferrites, ferromagnetics, electroluminescent materials, thermionic emitters and super-conductors.

Collection

Literature selected for indexing, abstracting, analysis and evaluation is found through the regular scanning of the DDC Technical Abstract Bulletin, NASA's Scientific and Technical Aerospace Reports, Ceramics Abstracts, Chemical Abstracts, Metals Review and other similar sources. In addition, an average of forty journals are screened on a current arrival basis. The collection currently contains over 27,000 references. The monthly accessions rate is about 400.

APPENDIX C

CHECK LIST:

**GUIDE TO DOCUMENTATION OF CLIENT FIRMS,
AND CLIENT/NERAC RELATIONS**

Check List:

Guide to Documentation of Client Firms, and Client/NERAC Relations

Purpose:

To provide for Applications Specialists, and others who establish and maintain Client relations in behalf of NERAC, a guide and a frame of reference to help insure that data which is significant and actually or potentially available is identified and noted in each Client file folder.

This Checklist is prepared and distributed on the assumption that - as a client - NERAC relationship is established and develops - activities will take place and attitudes will emerge which will result in the utilization of NERAC - available data, and in improved or innovated product/market achievement by the client. We believe that the recording of these activities and attitudes will make possible the case documentation of what has transpired. The study of the practices and growing capability of industrial firms to so manage information and to facilitate technology transfer and utilization is compellingly important in this period of accelerating technological progress. And the reporting of developments in industrial firms from the context within which they occur through the use of case format will provide the data necessary for this study.

- I. About the Client Firm - Data to be recorded as it becomes available, and to be sought as it becomes significant.

Size of firm/component?

place in its industry?

organization?

product line(s)?

Contact - how initiated, and position of client firm member involved?

Other company people involved, or to whom referred - and their identified role?

- II. Goals or objectives, operating philosophy, practices, concepts which appear to motivate or influence the firm's operations and effectiveness.

What do you see, hear, or infer which you feel helps you to better understand or "explain" the rate and direction of the firm's progress as it relates to the work and concerns of NERAC?

- III. Client-firm Practices in the Management of Information, in the Management of Innovation.

A. Re Information

- (1) residing in the firm

in the past training and experience of its personnel -
managerial, professional, technician, production workers

- (2) actively sought by the firm
 - to meet a present or anticipated need - may be sought by any of the personnel, and most likely by its managers or professionals
 - may be found in published material, through formal or informal contacts with others - consultants, friends or former associates, government or university sources, etc., etc. May include the firms participating membership in MIT's Industrial Liaison Office or Harvard Associates, etc.
 - may be sought indirectly through a key individual of the firm, whether technical librarian, engineering administrator etc. who is expected to be knowledgeable about sources.
- (3) may come to the firm unsolicited
 - who screens it
 - who scores it
 - who will be contacted in anticipation of its availability when needed.
- (4) role of management
 - to maximize availability and minimize time and cost of searching
 - to eliminate costs of duplication of effort
 - to relate nature and availability of information to the growth plans of the firm

B. Re Innovation

- (1) Sources of ideas
 - a. in response to identified needs
 - b. in anticipation of future market opportunities
 - c. sought for findings, and or by-products of planned research
 - d. "spontaneous" creations of idea - generators
- (2) organizational procedures
 - a. especially designated individual or group(s) to carry on development or problem-solving effort on continuing basis
 - b. problem-solving carried out by anyone where "problem" arises or occurs
 - c. management makes special "task" or "project" assignments
 - d. other arrangement
- (3) relationships established to further the work of innovation
 - a. by management
 - b. by those primarily responsible for development
 - c. by others concerned or involved
- (4) other observations which may help describe or explain the success, or lack of it, resulting from the innovative efforts of the firm

IV. Your Role and Relationship in the Firms Management of Information and Innovation

- A. During initial and preliminary contact and discussions with the firm's representative
 - (1) Source of contact; initiated by NERAC or firm
 - (2) Who (position, responsibility, and interest) is initial company contact
 - (3) How is possible contribution of NERAC to firm identified
 - (4) How related to possible company application or situation
- B. To whom are you referred within company and for what purpose?
 - (1) for specifically identified reasons
 - a. in context of a problem
 - b. to contribute to a company program
 - c. other
 - (2) for general good works reasons
 - (3) because they don't know what else to do
- C. Your relationship
 - (1) Do you feel that you and the function you represent to the company are being assigned a "role" in the company's effort
 - (2) What present activities or relationships seem to bode well for a continuing place in the firm's innovative effort?
 - (3) Do you foresee a time and relationship such that you will feel free to make "free-lance" suggestions in the company's interest?
- D. Can you differentiate between your impact as a person and as a representative of NERAC?
 - (1) What does your response suggest about the firm's work?
 - (2) About the acceptance of information and suggestions from external sources?
 - (3) or have you made yourself an "internal" source to those with whom you work?